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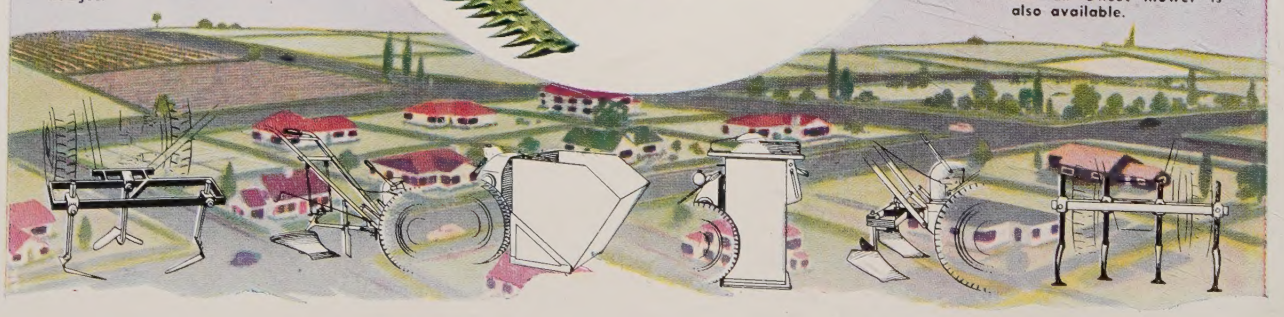

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This Month's Cover

The onset of spring in most parts of New Zealand is not as vividly defined as in countries which are under snow in winter, but among the most obvious signs is the flowering of early fruit trees and ornamentals such as the cherries shown on this month's cover. The cover has been reproduced from a photograph by National Publicity Studios of the botanical gardens in Palmerston North, centre of the Manawatu, one of New Zealand's richest farming districts. The steady growth of Palmerston North since it was first settled about 1870 has accompanied the rapid development of dairy farming, sheep farming, and, to a less extent, cropping on the fertile plains surrounding the city.

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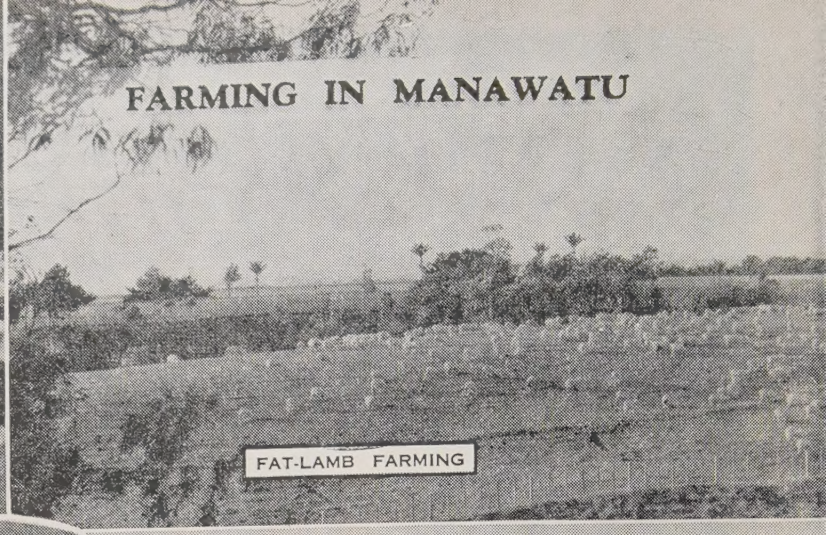
FARMING IN MANAWATU

BEEF CATTLE IN MANAWATU GORGE



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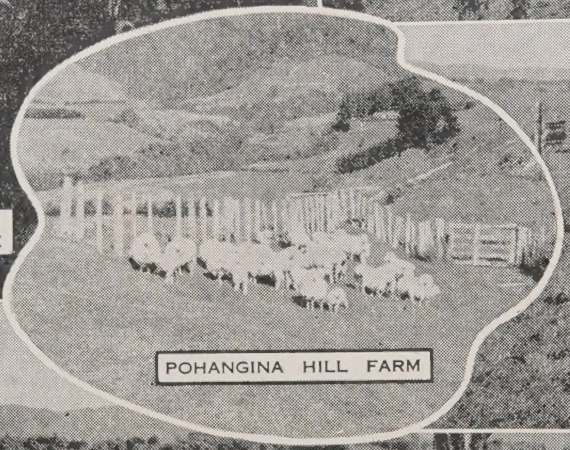
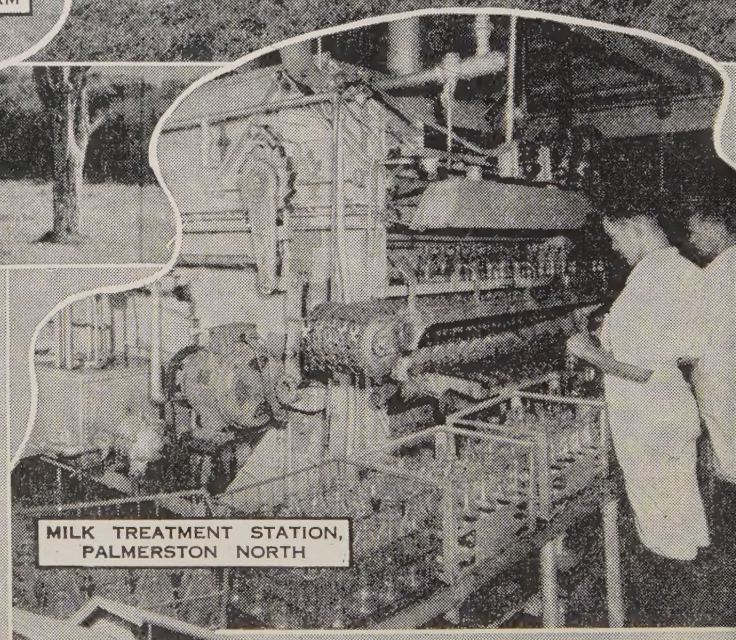


POHANGINA HILL FARM

BEEF STOCK, FEILDING

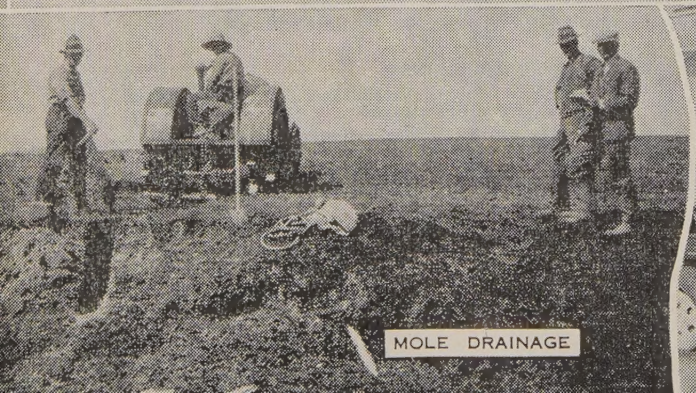
FRIESIAN MILKING HERD



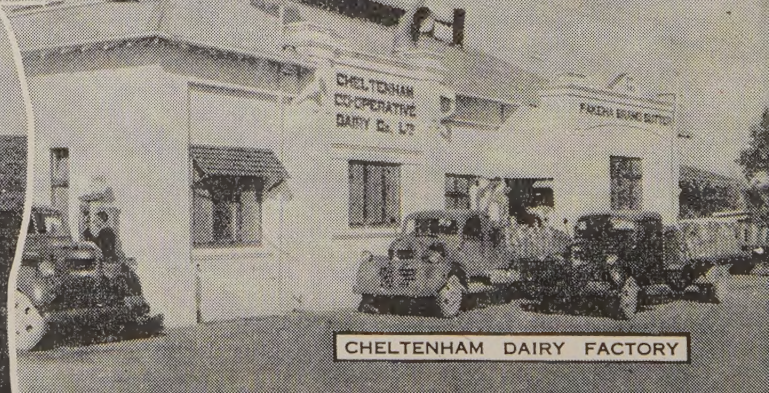
MILK TREATMENT STATION, PALMERSTON NORTH

The rich alluvial soil of easier country of Manawatu with its high-producing pastures of ryegrass, cocksfoot, and white clover supports considerable numbers of both sheep and cattle. In the north-eastern and south-eastern parts of the district to the east of the Ruahine Range semi-intensive sheep farming is the main activity, though extensive grazing farms are to be found against the ranges. These farms are generally situated on the less fertile hill country. In the centre to the east intensive sheep farming is carried on, but on all the better land dairying is associated with sheep fattening.

[Photographs at top left by "New Zealand Farmer", at top right, second left, and bottom right by National Publicity Studios, and second right by R. Steele.



MOLE DRAINAGE



CHELTENHAM DAIRY FACTORY

The FAO World Census of Agriculture, 1950

DURING 1950 nearly every farm holding in New Zealand of more than one acre located outside borough boundaries received a visit from an agent of the Census and Statistics Department collecting certain details about the holding. Farmers are well acquainted with the annual collection of statistical information undertaken by the local police constable on behalf of the Census and Statistics Department. For 1950 the schedule of questions was expanded because the collection formed part of the World Census of Agriculture initiated by the Food and Agriculture Organization of the United Nations. For such an important purpose it was decided that farmers should have the assistance of enumerators specially trained in the completion of the forms—hence the personal visits.

From articles and statements which have appeared from time to time in the "Journal" most farmers will have a good general idea of the aims and objects of FAO, which can be summarised as increasing the production and improving the distribution of world food supplies and raising the standards of living of rural peoples everywhere; and in the large eastern countries that includes nearly everybody.

Assessment of World Agriculture

From available statistical and other information the general state of world agriculture can be assessed and problem areas delineated, but it is clear that the fuller and more accurate the information available the clearer becomes the picture and the easier becomes the task of allocating very limited resources to the worthy objective of increasing production and raising standards of nutrition.

Hence FAO, at its very first session of conference at Quebec in 1945, decided to follow the example of its predecessor in the field of international agricultural statistics, the International Institute of Agriculture, which took a world census of agriculture in 1930 and planned for another in 1940. Preparations were made and early in 1949 FAO published its programme for the 1950 World Census of Agriculture, including a minimal list of items to be covered and an expanded list concerning which it might be difficult to obtain much-desired information.

The scope of the Census can best be indicated by quoting the following from the introduction to FAO's programme.

"In the 1950 World Census of Agriculture it is intended that each Government will obtain accurate and comparable information on its agriculture, including information on:—

(a) The number of agricultural holdings and their principal characteristics such as size, form of tenure, utilisation of the area, utilisation of labour implements and mechanical power, etc.

(b) The number and characteristics of the people who secure their livelihood from agriculture.

(c) Areas under crops and numbers of livestock.

(d) The volume of production of all important agricultural products."

A feature of the 1950 World Census was the inclusion of under-developed territories lacking in many cases any suitable statistical collecting agency and with the added difficulty that not infrequently the people themselves had little or no conception of land areas, which involved some form of mensuration or estimation of areas of the different crops by Government officers. New Zealand ran into this problem to a limited extent with respect to our Pacific Island territories, but every effort was made by the use of sampling techniques and other methods to take the Census, because it has been realised for some time that much fuller information on the agricultural resources of these islands is necessary to deal adequately with the problems of rapidly increasing populations and limited land areas characteristic of the Pacific Islands.

Detailed Information Required

What is true of these relatively tiny islands is even more true of the large under-developed areas of Asia, Africa, and to some extent South America. If countries in these regions are to improve their food supplies and raise their standards of living, it will have to be primarily from their own resources and, in the first instance, their own agricultural resources. Whatever development takes place in these countries, whether by use of their own capital or with the aid of the various international schemes of technical assistance now operating, the fundamental economic problem of applying limited resources to obtain the maximum return is greatly assisted if as much detailed information as possible is available on the land occupied, crops grown, and labour and livestock at present engaged in agriculture.

The World Census in New Zealand was completed during 1950, and although a considerable amount of tabulation work remains to be done on some of the more detailed aspects of the analysis, main results are now available, some of which were published in the supplement to the May issue of the Abstract of Statistics. Very few farmers, however, see this publication and I have discussed with my colleague the Minister in Charge of Census and Statistics some way by which farmers, who co-operated fully in completing the returns, should be made aware of at least the more significant results, and it has been decided to publish in the "Journal of Agriculture" a series of short articles giving, and briefly discussing, some of the main results. The first of these, dealing with holdings and farm horsepower, appears in this issue and will, I am sure, be read with very great interest by farmers and others interested in the economic health of our agriculture.

K. J. HOLYOAKE, Minister of Agriculture.

The Home Garden In October

By H. P. THOMAS, Vegetable Instructor, Department of Agriculture, Wanganui

WITH the approach of warmer weather renewed interest is created in home garden activities in October. Initial or successional sowings of most hardy kinds of vegetables may now be made, but small, regular sowings are advocated to avoid producing more vegetables than can be used when the crops reach maturity. Where there is little likelihood of late frosts seeds of half-hardy vegetables may be sown outdoors in warm positions. Tomato and kumara plants and main-crop potatoes may be set out where conditions are favourable. In the North Island frost-tender plants raised under glass last month may be planted out, but some protection for several weeks is advised.

CAUTION should be exercised with all frost-tender subjects, and experience should be the main guide in this respect. Early provision should be made for autumn and winter greens by making small sowings this month. Thinning, and transplanting of earlier-sown crops, may be carried out, and gaps filled in rows previously planted.

Attention should be given regularly to work such as moulding-up and staking for support, hoeing to assist aeration and weed control, manuring, and spraying to aid growing crops.

Sowing, Planting, and Maintenance

The final preparation of the soil and small general plantings will be the main work for the month. Areas dug earlier and left exposed to the weather can be lightly forked over to bring them to a fine friable tilth suitable for sowing and planting. Initial or successional sowings of most hardy vegetables such as peas, carrots, beetroot, lettuce, turnip, and spinach can be made during the month.

Toward the end of the month in central and northern districts where there is little likelihood of late frosts seed of half-hardy vegetables such as dwarf and runner beans, melon, pumpkin, squash, marrow, and cucumber may be sown outdoors in warm positions. Tomato and kumara plants may also be set out in favourable districts and additional plantings of early potatoes may be made, and second-early or main-crop varieties planted. In southern districts, however, November may be considered early enough for the sowing and planting of these half-hardy vegetables.

A start may be made for provision of late-autumn and winter supplies by making small initial sowings of savoy cabbage, broccoli (winter cauliflower), curly kale, leeks, celery, and brussels sprouts. Chokos, which are suitable for growing only in the North Island, should be set out during October, as these vegetables require a long season of growth. Jerusalem artichokes may still be planted.

Prompt attention to the earthing up of potatoes planted earlier will be necessary to protect them from late frosts or inclement weather.

Thinning of earlier-sown crops of silver beet, lettuce, and roots may need attention, and hoeing should be carried out whenever the state of the ground permits.

Silver beet, lettuce, cabbage, and cauliflower plants may be transplanted if seedlings are ready, and any gaps which have occurred in previous plantings should be filled in.

Earlier-sown peas will require moulding up and supporting to prevent them coming in contact with the soil.

Supports for tomatoes and runner beans can be placed in position and the ground worked up and prepared for planting later in the month.

Asparagus

In northern districts established beds of asparagus will now be making growth and any weeding necessary should preferably be done by hand to avoid damaging the young shoots. Weekly applications of organic liquid manure will be beneficial at this stage. Nitrate of soda or sulphate of ammonia, 1 to 2oz. to 4 gallons of water, may be used if animal manure is not available. When the spears are approximately 6in. long they should be cut 2 to 3in. below the surface of the soil with a sharp, long-bladed knife. Care must be taken during cutting to see that no damage is done to adjoining growths or crown buds.

Even with established beds it is not advisable to cut for more than 7 or 8 weeks each season.

Beans (Dwarf and Climbing)

In the North Island and Nelson an early sowing of either dwarf or climbing beans may be made from mid-October to the end of the month according to local conditions. All varieties of beans except broad beans are frost-tender and succeed only during the warmer periods of the year. Danger of frost should therefore be considered as past before seed of dwarf and climbing varieties is sown.

Both climbing and dwarf beans can usually be accommodated in most gardens. The runners (climbers), particularly some of the older varieties, yield more heavily and are slightly hardier than the dwarfs and with proper attention usually bear for a longer period. The newer, stringless, climbing varieties are also comparable in flavour and quality to the dwarf varieties. However, dwarf beans have the advantages of requiring less space for development, no support other than perhaps a moulding-up, and of reaching maturity more quickly than runners.

REMINDERS FOR OCTOBER

Sow: Artichoke (globe), brussels sprouts, *broccoli, beetroot, broad beans, *beans (runner and dwarf), cress, carrots, *cucumber, *cauliflower, cabbage, *celery, *celeriac, curly kale, *egg plant, kohl rabi, leek, lettuce, *melon, *marrow, mustard, onion (spring), parsley, *pumpkin, parsnip, peas, radish, spinach (summer), New Zealand spinach, silver beet, spinach beet, *squash, sweet corn, savoy cabbage, turnip, salsify, *tomato, watercress.

* For northern districts and where some protection from frost can be given if necessary.

Plant: Artichoke (Jerusalem), asparagus (in South Island without delay), cabbage (summer and autumn), cauliflower (summer and autumn), †cucumber, †kumara, lettuce, †melon, †marrow, onion (autumn sown), †potato (second early and main crop), †pumpkin, silver beet, spinach beet, ††tomato.

† Toward the end of the month in districts free from late frosts.

HEADING PHOTOGRAPH: A suitable method of supporting runner beans.

It is advisable to make successive sowings of dwarf beans if a continuity of supply is to be assured; most varieties of climbers will continue to bear until cut down by frosts, if the beans are picked regularly.

Perennial climbing beans should be well manured before planting, because of their semi-permanency, and it is advisable to dig a trench and half fill it with compost or well-decayed animal manure before topping off with soil. The best-known variety of runner bean is the Scarlet Runner, but other improved strains are Emperor Scarlet Runner, Princeps, Prizewinner, and Streamline. Because the scarlet runner type is a perennial it may be left in the ground for several years and will shoot again when the weather is sufficiently warm and produce pods a fortnight earlier than seed sown in spring.

Sowing

Beans can be grown on a wide range of soils, but a well-drained, easily worked loam with a moderate humus content is preferable. Clay soils and low-lying areas are unsuitable, as with insufficient drainage plants become yellow in wet weather and are seriously checked. However, lack of moisture at the roots during a spell of dry weather is a frequent cause of non-setting of the flowers or check of growth of the young beans, and for that reason sandy soils or soils lacking in humus should be avoided unless a supply of moisture can be assured under such circumstances.

A dressing of carbonate of lime at ¼lb. per square yard should be applied to soils not previously dressed.

A fertiliser mixture of 1 part of superphosphate plus ¼ part of sulphate of ammonia is recommended for beans and should be applied at the rate of 10 to 14oz. to 7yds. of row. The mixture should preferably be worked into the top 4in. of soil before sowing, but if it is lightly hoed into the surface alongside rows, a watering should then be given.

Supports

Where a suitable fence or trellis is not available runner or climbing beans should be provided with supports. Single rows or double arched rows of poles or stakes (depending on whether planting is to be made on one or both sides of supports) approximately 8ft. high are satisfactory. Beans may also be supported by a wire-netting fence firmly erected or by wires on a fence system with string or pea sticks running vertically from the wires. Another method is to embed 3 or 4 stakes 8ft. or longer firmly in the ground 18 to 24in. apart so that they form a square or triangle and to incline them inward so that they may be tied at a point near the top.

Bean seed should be planted from 2 to 3in. deep, according to whether the soil is heavy or light. Runner beans are usually sown sparingly so that seedlings can be thinned to from 8 to 12in. apart. If possible, rows should be 3 to 4ft. away from other vegetables. Dwarf beans may be staggered in wide rows of 2 or 3 lines with 4 to 6in. between seeds and 2ft. to 2ft. 6in. between rows.

Some recommended varieties are:—

Perennial runner: Improved Scarlet Runner and Streamline.

Tall or climber: Fardenlosa and Market Wonder.

Dwarf: Pale Dun, The Prince (early), Canadian Wonder (Burnley Selection), Tender Green, and Black Valentine (main crop).

Butter: Sure Crop Wax, Golden Wax, and Bountiful Wax.

Lima Beans

The culture of lima beans, which are fairly high in food value, is similar to that of french beans, but it is often advisable to sow the seed a little later, even though the beans require longer to mature. They are more sensitive to cold than even snap or waxpod beans and succeed only in favourable districts. Climbing and dwarf varieties are available and the beans can be shelled and cooked like broad beans or used dry in the same way as haricot beans. If they are used in the dry state, they are improved by being soaked overnight.

There are dwarf and tall types of lima beans. Good dwarf varieties are Burpees Bush, Baby Fordhook, and Baby Potato; a satisfactory tall variety is King of the Garden.

Edible Soya Beans

Culture of edible soya beans is similar to that of bush lima beans. The soya bean will grow well in nearly all types of soil, but it does best in rich loams. Where plants are grown for the first time they usually make poor growth unless the seed has been inoculated. They require certain strains of bacteria not normally present in New Zealand soils, and if soya bean seed is planted in the same ground in succeeding years, there will be a marked improvement in growth. No further attention to inoculation will be necessary if soya beans are grown in the same ground at least every 3 years.

A method often used in inoculating the seed consists of moistening a bushel of seed with a solution of 3oz. of glue or sugar dissolved in a quart of water and then thoroughly mixing the seed with 2 quarts of finely sifted inoculated soil. Inoculated soil may be obtained from an area where soya beans have been grown recently. Inoculated seed should be sown as soon as possible after treatment, and as strong sunlight may kill the bacteria, a dull day is best for planting.

Seed should be planted 4in. apart 1½ to 2in. deep in rows 24 to 30in. apart.

Varieties: For New Zealand conditions the most suitable varieties, in order of maturity, are Mandarin (100 days), Ito San (105 days), and Manchu (110 days).

Beetroot

Like most root crops beetroot does well in soil that has been heavily dressed with organic manure for a previous crop. The first of the successive sowings of beetroot should be made in October with the globe varieties. Cultivation should be deep and thorough, and good drainage is essential. Where the ground has been previously heavily manured a dressing of 1 part of blood and bone and 2 parts of superphosphate at the rate of ¼lb. per square yard worked into the top 3in. of soil will give satisfactory results.

As beetroot is sensitive to soil acidity, lime is usually necessary on soil not recently dressed. Carbonate of lime at 3 to 4oz. per square yard and well worked in some time before sowing is normally all that is required. Care must be taken, however, to see that too much lime is not applied.

Seed should be sown ½in. deep in rows 12 to 15in. apart and plants later thinned to 3 to 5in. apart. Care should be taken when thinning is done to leave one plant only, as usually two or more grow from the same seed vessel.

Good varieties are Detroit Dark Red, Crimson Globe, Derwent Globe, Egyptian Turnip Rooted, Obelisk (half long), and Maori King (long).

Cabbage and Cauliflower

As harvesting of autumn-planted spring cabbage should now be under way, planting from October onward must be considered.

Cabbage and cauliflower plants grown from seed sown earlier can be set out 18 to 24in. apart in rows 24 to 30in. apart. Where soils are likely to be acid a dressing of carbonate of lime at 4oz. to the square yard should be made. A fertiliser mixture composed of 2 parts of blood and bone, 1 part

[*Sparrow Industrial Pictures Ltd. photo.*
It is considered that no work is as beneficial to the growth of vegetable plants as frequent light cultivation; therefore hoeing among growing crops should be done regularly.

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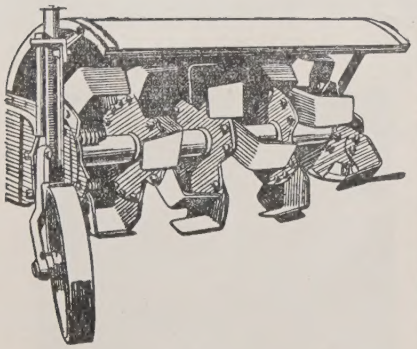

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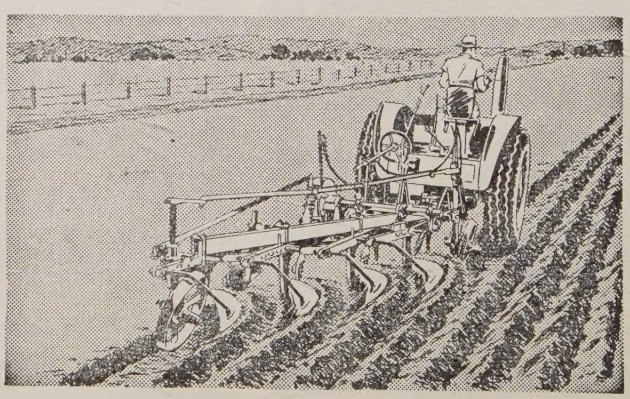

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of sulphate of ammonia, and ½ part of sulphate of potash, all by weight, and distributed at the rate of ½lb. to each 6ft. of row should give plants the stimulus necessary at this time. To avoid the possibility of burning the roots of the young plants, the fertiliser should be well mixed with the soil before planting.

Varieties

Plants of the following varieties of cabbage and cauliflower transplanted as soon as possible will give a succession of cutting through summer and autumn, because of their varying maturity periods.

Cabbage: Golden Acre, Copenhagen Market, and Henderson's Succession.

Cauliflower: Early London or Phenomenal Early, Veitches Autumn Giant, and Phenomenal Main Crop.

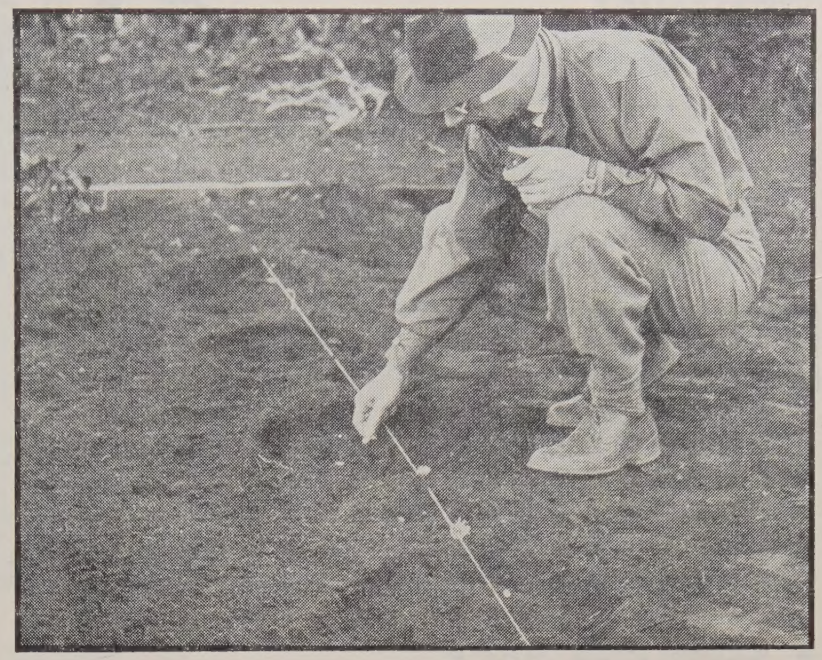
Carrots

A successional sowing of carrots or the main crop can be sown this month. However, where the depredations of the carrot rust fly are severe infestation may be reduced if the seed of the main crop is sown in November or early December. The sowing of the main crop is sometimes deferred until late December or January if earlier sowings in the past have been seriously infested by carrot aphis.

Ground that has been heavily manured for a previous crop should be selected for carrots. As with most root crops it should be well drained and deeply cultivated.

Superphosphate applied at the rate of 2oz. per square yard and broadcast after digging will be beneficial on most soil which has been cleared of a crop that was heavily manured. If dry wood ashes are available, these may be broadcast over the soil and raked in before sowing the seed. Fresh manure should not be used, as this causes misshapen or forked roots.

Except in heavy soils, which consolidate and prevent expansion, carrots rarely need thinning if sown thinly. In heavy soils or where large-rooted varieties are grown plants can be thinned 4 to 6in. apart.



[Green and Hahn Photography Ltd. photo.

Where favourable conditions prevail in the North Island cucumber, marrow, and pumpkin may be sown outdoors from early October, but elsewhere sowings should be deferred until November unless some protection can be given to young plants until all danger of frost is past.

Seed should be sown ¼ to ½in. deep in drills 12 to 15in. apart. Recommended varieties are:—

Early: Early Short Horn, Early Krop, and Early Market.

Main crop: Chantenay, Manchester Table, Nantes, and James' Intermediate.

Celery and Celeriac

A further sowing of celery and celeriac may be made this month. If the golden self-blanching kind of celery is chosen, no time should be lost in sowing it in districts where early-autumn frosts are experienced. The turnip-like roots of celeriac may be used for salads or cooked like other root crops. The culture of celeriac is similar to that of celery, but as celeriac is not blanched and is less exacting in its requirements, it should be grown more extensively in home gardens. Plants from seed sown now should be ready for setting out in the garden during December and January. Information on sowing and varieties of celery was given in last month's "Journal".

[Green and Hahn Photography Ltd. photo.

The simplest way to plant potatoes is to open a trench 5 to 6in. deep, and then to apply the fertiliser, which should be well mixed with the soil before the tubers are planted. The soil is drawn back over the tubers, forming a shallow ridge.

Cucumber, Pumpkin, Marrow, and Melon

The sowing of cucumber, pumpkin, marrow, and melon seed outdoors may be done in most districts during October, but where there is a likelihood of late frosts or inclement weather, particularly in the south, plants should be protected by using hot-caps or cloches.

If the home gardener wishes to raise his own plants, sowing should be done as soon as possible and the seed containers (preferably small paper or crockery pots) placed in the warmest position. Where facilities such as a glasshouse, hot-bed, or cold frame are not available a glassed-in porch, improvised frame, or cloches would be suitable.

Young plants after attaining a suitable size should be hardened off before planting by gradual exposure to outside conditions.

Planting

The recognised safe date for planting out frost-tender plants will vary from mid-October in the North Island to perhaps mid-November in the South Island. Further information on planting was given in last month's issue of the "Journal".

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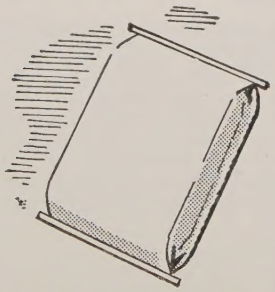

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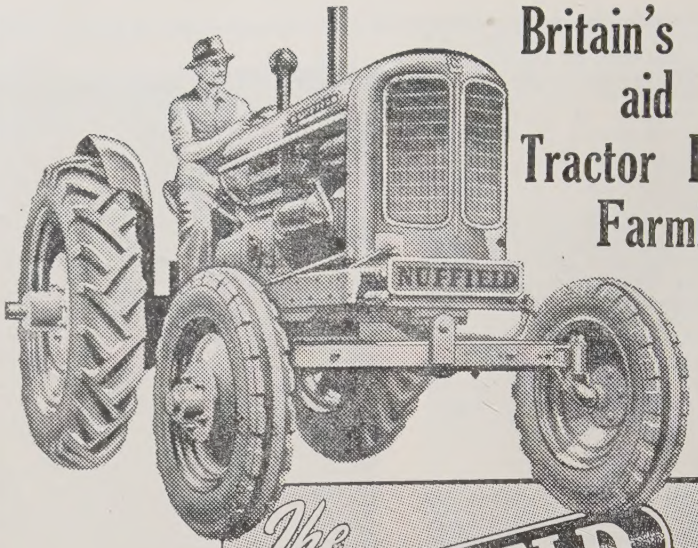

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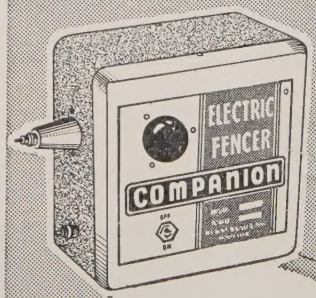

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Tins with the bottoms removed used to shelter young tomato plants.

Varieties

Of the many varieties the following are popular in home gardens:—

Pumpkin: Ironbark, Queensland Blue, and Triamble.

Squash: Warren Squash (early), Green Hubbard, and Golden Hubbard (main crop).

Melon: Several varieties of pie melon, watermelon, and rock melon.

Marrow: Long Green Bush, Long White Bush, and Custard Golden.

Cucumber: Long (and Short) Green Prickly and Crystal Apple.

Leeks

Leek seed should be sown without delay. Leeks require a long growing period, and although very adaptable as to soil conditions, are gross feeders and respond well to liberal manuring and watering. Leeks together with other winter-maturing vegetables play such an important part in ensuring a continuity of yearly supplies that they are worthy of any extra time and effort which may be needed in their initial stages of growth and establishment.

Onions

In most South Island districts it is customary to sow main-crop onions in September. If this has not been done, a sowing may be made early in October. For long storage Pukekohe Longkeeper and Turbot are recommended. High-yielding varieties for more immediate use are Ailsa Craig and Giant Rocca.

Parsnips

As parsnips require a long season of growth, a sowing should be made in October in southern districts, but in the north sowings may be made in November or even December. Parsnips are primarily a crop for late-autumn or winter use, but they must be sown sufficiently early to enable them to reach full development before growth slackens in late autumn. They take at least 5 months to mature and are of better flavour after being subjected to frosts, and providing the soil is well drained they will "stand" well if left in the ground during the severest winter.

Parsnips are very sensitive to soil acidity and most soils where they are to be sown should be dressed with lime at 3 to 4oz. to the square yard if a dressing has not been applied the previous year. Parsnips grow well in most soils, but a deeply cultivated well-drained soil that has been liberally manured for a previous crop is best.

Before sowing, superphosphate at the rate of 2oz. per square yard and, if available, dry wood ashes broadcast over the ground and raked in will benefit the crop. As parsnip seed is often difficult to germinate, it should be sown fairly thickly ½in. deep in rows 18in. apart in soil that has been worked down to a fine tilth. Where difficulty is experienced with germination the following method is worth trying: Open a drill about 3in. deep and fill it with leaf mould, firm this, sow the seed, and then cover it with some fine leaf mould, which should be kept fairly moist.

Seedlings should be thinned 1 to 2in. apart when they are about 2in. high, and later when the roots have become a usable size for soups and stews they can be given a final thinning to 4 to 6in. apart.

For show roots or very good garden specimens ground should be dug to a depth of 2ft. or more. The average home gardener finds this rather laborious and an alternative method is to make holes 9 to 12in. apart with a crow-bar and fill them with fine rich soil prepared after the manner of a potting compost. This soil is firmed and 4 or 5 seeds are sown in each hole. After seeds have germinated all but one strong plant should be removed.

Varieties: Hollow Crown is recommended; others are Student and Model.

Peas

Peas should be sown every 3 weeks to obtain a continuous supply. Where possible some form of support should be given, either by wire netting, criss-crossed sticks, brushwood, or string surrounding firm supports. As the plants grow the soil surface should be frequently stirred and loosened, and earthing-up should be begun when they are about 3in. high.

Varieties: William Massey, Blue Bantam, and Greenfeast (dwarf varieties); Alderman, Coronation, and Quartermaster (tall).

Sugar or edible-podded peas are worth a trial where space permits.

Potatoes

Early-planted potatoes should be kept earthed up and all weeds should be removed. In northern districts, where early plantings are likely to be well advanced, plants should be sprayed with Bordeaux to protect them from potato blight.

It may still be inadvisable to make main-crop plantings in early October in some areas, particularly in districts subject to late frosts, but generally planting of the main crop can proceed.

Tubers do not need to be sprouted, but sprouting of both early and main plantings is of value, as it gives the plants an early start and in most seasons an earlier crop results. Plants from potatoes that have been greened and sprouted are at least a fortnight earlier than those from tubers not treated.

Liming is rarely necessary, as the potato is tolerant of acid conditions.

An artificial fertiliser mixture of 3 parts of superphosphate and 1 part of sulphate of ammonia may be applied at

the rate of 6 to 12oz. to 6yds. of row, or equal parts of superphosphate and blood and bone can be used.

The simplest way to plant is to open a trench about 5 to 6in. in depth and then apply the fertiliser, which should be well mixed with the soil. The tubers can be set at 12 to 18in. apart in rows 2 to 2½ft. apart. (The close planting, however, is usually only applicable to early crops.) The soil is then drawn back over the tubers, forming a shallow ridge or mould. The position of the rows should be marked with sticks at the ends, as this will allow surface cultivation to be carried out without injuring the young shoots before they appear above ground.

If the tubers are large (4oz. or more), they can be cut into 2 or more sets, but each portion should have at least 2 eyes and a minimum of cut surface.

Varieties: Recommended main-crop varieties are Aucklander Short Top and Arran Chief (white varieties), Dakota and King Edward (main-crop varieties favoured in the South Island), and Inverness Favourite (late white and a heavy cropper). Of late years the recently introduced varieties Chippewa and Sebago are accounting for a greater acreage each year.

Salad Vegetables

Successive sowings of lettuce, radish, spring onion, and mustard and cress should be made as required. To obtain crispness, these crops should be kept growing rapidly. Details on the cultivation of these crops and of recommended varieties were given in last month's "Journal".

Tomatoes

Tomato plants may be planted out from mid-October in most northern districts, but it will not be safe except in a few favoured areas to begin planting outside in most southern districts until the middle of November.

Most gardeners prefer to purchase plants and it is advisable to obtain these from a nurseryman who uses sterilised soil and produces stocky, well-grown specimens. If plants are healthy and have been properly hardened off, the foliage should be free from blemish and the base of the stems dark purple; if plants are purchased in the box and they appear rather tender, they should be hardened off gradually before being planted out, particularly if the weather is uncertain.

Soil preparation should be begun early. A deeply dug, well-drained soil rich in humus and a sheltered situation which receives the maximum amount of sunshine are best. The organic material should, however, preferably be dug in some time before planting, and an application of lime, 3 to 4oz. per square yard, should have been applied the previous autumn.

Before planting, a fertiliser mixture of equal parts of superphosphate and blood and bone plus 5 per cent. of sulphate of potash should be spread along the row at the rate of 8oz. to 6ft. of row and mixed into the top 6in. of soil. If stakes have not already been set out, this should be done before plants are put in to avoid possible damage to the roots later.

Dwarf varieties do not require supports, but will produce better-quality fruit if they are prevented from coming in contact with the soil, particularly if showery weather is experienced. Wires or long wooden slats set about 6 to 8in. on either side of the plants should give the necessary clearance from the ground. Dwarf varieties require more space than do tall ones and should be planted 3ft. apart each way.

Spraying

To protect tomatoes from late blight, stem borer caterpillar, and tomato worm caterpillar the following spray should be applied at 10-day intervals from the time of planting out: Bordeaux mixture and D.D.T. prepared from 4oz. of bluestone and 5½oz. of hydrated lime in 4 gallons of water plus ½oz. of D.D.T. 50 per cent. wettable powder. Copper oxychloride may be used instead of Bordeaux mixture if desired.

Varieties

Suitable varieties of tomatoes are:—

Dwarf: South Australian Dwarf Red, Pearl Harbour, and Tatura Dwarf Globe.

Tall: Potentate, Best of All, Market King, Supreme, and Abundance.

Winter Greens

Sowings of brussels sprouts, broccoli (winter cauliflower), red pickling cabbage, savoy cabbage, borecole, and sprouting broccoli should be made during October to provide a supply of greens for late autumn and winter. Sowing dates should be varied a little according to variety and district. Brussels sprouts are a delicious winter vegetable and successional crops can be grown in most districts so that they are available from early winter to August.

Broccoli varieties can be chosen to spread maturity dates throughout late autumn, winter, and early spring.

The season for savoy cabbage is similar to that for brussels sprouts, although they are usually grown for cutting in late autumn and winter, when the effect of frost on the mature hearts appears to be beneficial.

Borecole and sprouting broccoli are very hardy and among the latest of the winter greens and should be grown more generally.

It is important that most of these plants become fairly well established before winter, though with very late varieties it is not desirable for growth to be too far advanced.

Seed of the vegetables mentioned should be sown ¼ to ½in. deep in rows 1ft. apart in a seed-bed rich in humus and worked to a fine tilth. With average growing conditions young plants should be ready for planting out in from 6 to 8 weeks.

One advantage of raising plants is that it is possible to get a greater range of varieties than can usually be bought from seedsmen.

Varieties

Savoy: Continuity of supplies may be maintained by planting several varieties such as Ormskirk Early, Chieftain, Drumhead, and Omega (late).

Broccoli: Many varieties which mature from late autumn to late spring are available; examples are Michaelmas Early White, Veitches Self-protecting (early), Mammoth Winter White, Snows Improved (winter), Lily White No. 2, St. Valentine (spring), and Late Queen (late spring).

Brussels sprouts: Scrymger's Giant, Giant Fillbasket, and Long Island Improved.

Red or pickling cabbage: Red Dutch and Mammoth Rock Red.

Borecole: Dwarf Green Curled and Tall Green Curled.

Sprouting (non-heading) broccoli. Calabrese, Green Sprouting, and Purple Sprouting.

METEOROLOGICAL RECORDS FOR JULY

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in Inches					Bright sunshine hours
		Approx. mean	Difference from normal	Absolute maximum and minimum		Total fall	No. of days of rain	Difference from normal	Maximum fall		
				Maximum	Minimum				Amount	Date	
Kerikeri	201	50.6	+ 0.6	66.2	29.0	6.61	15		1.50	3	125.2
Auckland	160	52.6	+ 1.1	63.0	36.3	5.88	26	+ 0.20	1.35	21	102.2
Tauranga	10	48.8	+ 0.4	60.8	29.7	13.70	14	+ 8.64	5.30	5	128.9
Ruakura	131	46.2	— 0.3	60.8	24.0	5.81	18	+ 0.97	1.19	4	96.4
Rotorua	969	45.6	+ 1.0	58.5	27.1	11.55	16	+ 6.57	3.68	4	115.5
Gisborne	12	48.0	+ 0.4	63.1	28.9	3.88	13	— 0.45	2.33	6	148.4
New Plymouth ..	160	49.2	+ 0.6	58.9	32.2	9.30	21	+ 2.98	1.84	4	122.0
Napier	5	47.2	+ 0.4	64.3	29.7	2.61	9	— 0.95	0.94	27	139.3
Karioi	2125	41.3	+ 2.1	61.0	22.0	5.79	15	+ 1.78	1.22	5	
Wanganui	72	47.6	+ 0.8	62.0	31.2	2.90	15	— 0.36	0.57	11	102.6
Palmerston North .	110	46.0	+ 0.5	61.0	27.5	4.51	18	+ 1.40	1.10	5	87.9
Waingawa	350	45.6	+ 1.5	66.0	25.0	4.97	17	+ 0.85	1.44	5	111.0
Wellington ..	415	47.2	+ 0.9	59.1	33.8	3.56	14	— 1.53	0.70	23	113.5
Nelson	24	45.6	+ 0.3	59.5	27.6	5.54	14	+ 2.11	1.52	21	144.1
Blenheim	12	45.3	+ 0.8	62.1	26.0	2.66	12	— 0.07	0.53	18	166.8
Hokitika	12	45.0	+ 1.3	57.8	27.0	15.67	21	+ 6.96	3.50	18	93.0
Hanmer Springs ..	1225	38.6	+ 0.5	62.0	12.5	3.05	12	— 1.21	0.65	26	119.0
Christchurch ..	22	43.2	+ 1.0	63.9	24.6	1.70	11	— 0.96	0.51	11	134.2
Ashburton	323	43.0	+ 2.9	64.8	24.0	1.33	7	— 1.32	0.56	18	148.1
Timaru	56	41.2	— 0.1	63.0	23.8	0.60	6	— 1.13	0.35	18	136.3
Alexandra	520	36.4	+ 0.5	58.6	17.1	1.34	13	+ 0.69	0.69	18	120.2
Taieri	80	42.3	+ 1.3	65.5	22.8	2.91	12	— 0.12	0.58	7	101.4
Invercargill ..	32	41.6	+ 0.9	58.0	23.0	2.98	17	— 0.02	0.40	6	90.3

Foot-rot in Pigs

By W. H. BISHOP, Veterinary Research Officer, Department of Agriculture Animal Research Station, Ruakura

DURING the last few years an increasing number of pigs have been attacked by a disease popularly known as foot-rot. A large percentage of these cases have occurred in Northland and south Westland, but it is probable that the number of cases as compared with the total number of pigs in these areas is very small. Individual farms have had an abnormally high number of cases, which has caused pig owners to take a serious view of the position. Foot-rot is known in all other areas in New Zealand, but it has not occurred to the extent that the farmer has been able to see any appreciable monetary loss as a result of its occurrence, and certainly he has not deemed it necessary in most cases to call in skilled assistance. Thus, no definite indication exists as to its economic importance, except perhaps in the badly affected areas mentioned.

THE disease is usually of a chronic nature. This means that as a result of the entry of disease organisms into the foot a slow but persistent inflammation is set up. There are two organisms responsible; a member of the fusiformis group of bacteria and a larger organism known as a spirocaete. Both of these "bugs" cause the well-known skin disease of pigs called necrotic ulcer, which many farmers recognise as large, ugly sores on the head and shoulders and round castration wounds. There is little pathological difference between the two diseases.

Little Resemblance to Sheep Foot-rot

Foot-rot in pigs has few points of resemblance to its namesake in sheep; due to the different conformation of the leg and foot in the pig it usually affects the coronet and higher structures.

There is no evidence that pigs become affected with foot-rot after running on country on which sheep with foot-rot have grazed, and vice versa. Pig foot-rot would appear to have a greater resemblance to foul of the foot in cattle, and actually both animals respond to similar kinds of treatment.

Foot-rot starts as a simple lameness, usually involving the outer digit of either fore or hind feet. It causes the pig to carry the affected foot off the ground and show great reluctance to move. In a few days there are intense pain and swelling of the structures immediately above the coronet and extending upward to above the fetlock. There is generally evidence of a definite crack in the horn in the region of the heel, which in the pig is fairly prominent and liable to injury. It is probable that organisms gain entry through such a fault. The swollen area becomes hot and inflamed and the pig shows resentment when the area is pressed with the fingers. If the trouble is not treated at this stage, a necrotic area will form, which will ultimately break at the surface with a small amount of discharge, followed by hard fibrous thickening which in the majority of cases will not get smaller and the pig will have a permanently thickened joint. The illustrations on this page show a typical untreated case. A portion of one toe has been cut away to reveal necrotic areas surrounded by gross fibrous thickening and consequent deformity of the foot.

The factors that aid the entry of organisms into the tissues are not fully understood. Various theories have been advanced, and it is probable that more than one set of conditions is necessary to bring about foot-rot.

Outbreak in Ruakura Piggery

Late in 1947 a number of cases of foot-rot occurred in pigs in the piggery of the Department of Agriculture Animal Research Station, Ruakura. Lameness was evident, with no outward symptoms of foot swelling and no visible break in the skin. In other cases there were intense pain, swelling on the coronet and fetlock, and ulceration. Typical causal organisms were found. It is possible, under the conditions of management of the Ruakura herd, by recourse to detailed records to arrive at some conclusions about certain aspects of the disease.

Source of Information

The general system of management at Ruakura is as follows: Sows are farrowed in houses attached to grass runs, and sows and suckers have access to grass for about 2 to 3 hours per day. At weaning, litters are transferred to an indoor fattening house and from this time onward have no access to pasture. Most of the pigs are in this category. In addition, a number of pigs were kept in an experiment in which an attempt was made to measure the effect of grazing on the efficiency of feed utilisation. In this experiment pigs were kept under 3 methods of management:—

1. Pigs kept continuously on concrete.

2. Pigs allowed off concrete for 2 hours weekly.

3. Pigs allowed on concrete only at feeding time.

The findings below relate to pigs showing lameness. Cases at Ruakura were treated as soon as lameness occurred, and thus foot-rot with typical manifestations was seldom seen. Nevertheless it is fairly certain that had treatment been neglected all cases would have developed to typical foot-rot. In 3 years 79 cases occurred.

Results

Management factors: The opinion has been widely held that the increasing tendency on the part of farmers to confine fattening pigs to concrete has been a contributing factor in the increase of foot lameness in areas where the disease has assumed importance. Findings at Ruakura do not support this opinion. An experiment with animals of the same initial weight which were grown at the same speed and spent the same time in the experiment showed that the only differences of any significance were those associated with management methods. The details were:—

	Treatments		
	Continuously on concrete	On pasture 2 hours weekly	On pasture between feeds
Number of pigs ..	18	18	18
Number of lameness cases ..	10	6	10

There was no difference between the number of cases of lameness in pigs kept continuously on concrete and those kept almost continuously on pasture. It appears that if much foot-rot infection is present in a piggery the type of surface on which pigs are kept does not necessarily influence the ease with which foot-rot organisms can enter the tissues. In

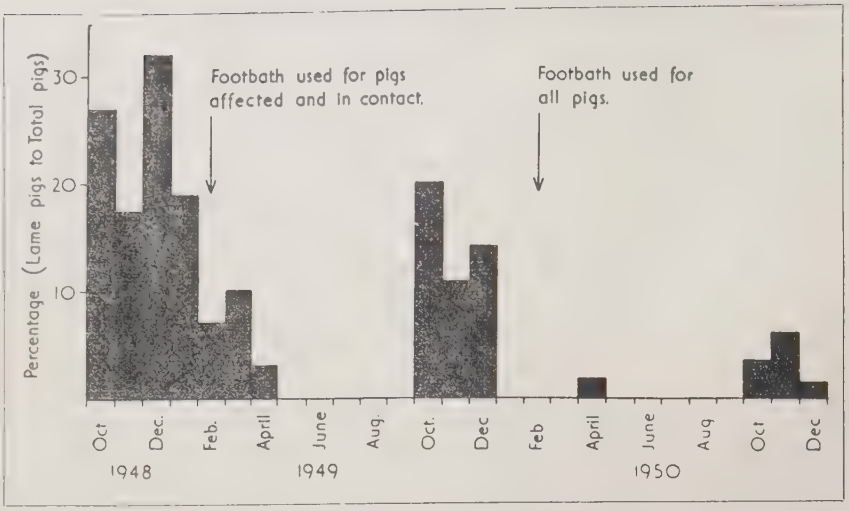
Foot-rot in a pig, showing a typical crack in a hoof.

fact, it is frequently found in the field that foot-rot and its associated disease, necrotic ulcer, appear in their most severe form under widely differing housing and flooring conditions. Concrete of a more abrasive type than that found in the Waikato district may, however, be associated with a higher incidence of trouble.

Age influence: It was found that only pigs in the porker- and baconer-weight classes have shown signs of foot lameness attributable to foot-rot. The average liveweight of pigs that contracted the disease was 130lb. The reason for this is not clear, but it is thought that there is a tendency for hoof cracks to widen and deepen, allowing entry of organisms as pigs get heavier. Older pigs are liable to have more brittle feet, which will crack more easily. It may well be that as pigs get older the resistance of the foot tissues is lowered to the degree where infection having once gained entry will spread. It is obvious that pigs as they get fatter are more prone to lie down for longer periods with the result that the sides of the hoof and coronet are unduly abrased and damaged.

Seasonal influence: The diagram on this page shows the incidence of lame pigs by months. The values shown were the number of lame pigs expressed as a percentage of the total number of porkers and baconers on hand in each month. It is apparent that lameness occurred only between October and April, and was particularly marked in 1948, when no preventive measures were in force. The seasonal incidence is difficult to explain, but may be associated with the weight factor. Raised atmospheric temperatures may possibly have some bearing on the ability of the organism to increase in numbers on the skin or apart from the pig.

Treatment: Whatever the disease, the earlier treatment is applied the more successful will be the outcome. This holds true for foot lameness in pigs. If pigs are allowed to continue lame until the stage is reached where chronic thickening occurs, the chances



of recovery are greatly diminished. This was borne out by results at Ruakura. At the first sign of lameness pigs were injected with a soluble sulpha drug deep into the depression behind the ear. This site is recommended because it is easy of access and a fairly large volume of fluid can be placed under the skin without fear of abscess formation, provided reasonable hygiene precautions are taken. During 1950 penicillin injected by the same route was used, but results at Ruakura did not indicate any advantage of using penicillin instead of sulpha drug.

Most pigs treated responded satisfactorily when treated early enough.

Local treatment of the affected foot was not carried out and is not advocated.

Preventive measures: In an endeavour to reduce the number of lameness cases which were always liable to affect the results of experiments being conducted, it was decided in February, 1949, to install a concrete footbath through which pigs could be run. It was simple in design, approximately 4ft. square and 3in. deep, and built within easy access of the piggery to keep the drafting race as short as possible. A bath of these dimensions will hold approximately 15 gallons of water, with sufficient depth to prevent dip splashing over the sides of the bath and yet deep enough to cover the foot. A 20 per cent. solution of powdered copper sulphate (bluestone) in water was used. During 1949, only affected pigs were run through the bath, together with in-contact animals. Pigs which had no obvious infection were not subjected to the solution. In 1950 all pigs under all experimental conditions except suckers were run through twice weekly. There was no tendency to drink the contents of the bath, but care was taken to see that no copper solution was allowed to contaminate foodstuffs, drinking water, or pasture. The diagram indicates the percentage of lameness cases before regular use of the bath compared with that subsequently. The numbers have been appreciably reduced to the stage where at present the disease is almost nonexistent. Not enough time has elapsed to allow decisive conclusions to be drawn, but the figures are sufficiently hopeful to warrant the time and trouble involved.

Summary

A number of characteristics of the disease as it affected the Ruakura herd during a 3-year outbreak are:—

It occurs almost invariably within a certain age group.

It occurs only in spring and summer.

On affected premises the disease occurs irrespective of the management conditions under which pigs are kept.

It can be controlled by using sulpha drugs and penicillin, provided they are used at the first signs of lameness.

It can be prevented by regular use of a footbath containing bluestone solution, through which all pigs are run.

The possible serious consequences of this outbreak were greatly mitigated by early treatment of cases, and subsequently foot-rot was eradicated by the preventive measures outlined, despite the probably continuous presence of the causal organism in the soil and buildings.

Retirement of Mr. H. J. Petch

AFTER spending the whole of his working life in the dairy industry and nearly 27 years with the Dairy Division of the Department of Agriculture Mr. H. J. Petch, Assistant Director of the Division, retired on July 31.

Mr. Petch was born in 1886, and after occupying various positions with dairy companies in Rangitikei and Taranaki, joined the Dairy Division as a Dairy Instructor and Grader at Auckland in 1924. The following year he was transferred to Hamilton as Assistant Butter Instructor for the Waikato and Poverty Bay districts. In 1926 he was appointed instructor to the northern half of the South Island, later taking over butter instruction work for the whole of the South Island. In 1938 he returned to Hamilton, became Supervising Butter Instructor for the North Island in 1939, and was made Superintendent of Butter Instruction for the Dominion in 1945. He was appointed Assistant Director of the Division in 1946.

[*Photo News Ltd. photo.*
Mr. H. J. Petch.

Mr. Petch has been succeeded by Mr. J. H. Earl, formerly Superintendent of Grading, Wellington.

LOW-VOLUME SPRAYERS: Principle and Components

THE discovery of hormone weedicides and the advent of low-volume spraying equipment made possible a new era in weed control in pastures, crops, and waste spaces in New Zealand. Whereas previously non-selective weedicides were used diluted in large quantities of water, weeds can now be removed selectively from a pasture or a crop without damage to either by using only small quantities of water with the weedicide. The increased selectivity of the weed kill, the saving in time and labour, and the low capital outlay for the low-volume sprayer have popularised a new movement in weed control that is growing rapidly. This, the first section of an article by C. J. Crosbie, Machinery Instructor, Department of Agriculture, Christchurch, is intended to give an understanding of the principle and components of the machine. For the mechanically minded farmer the second section, to appear in next month's "Journal", will give information about the building of such a machine and its operation.

[*D. Ross MacKay photo.*

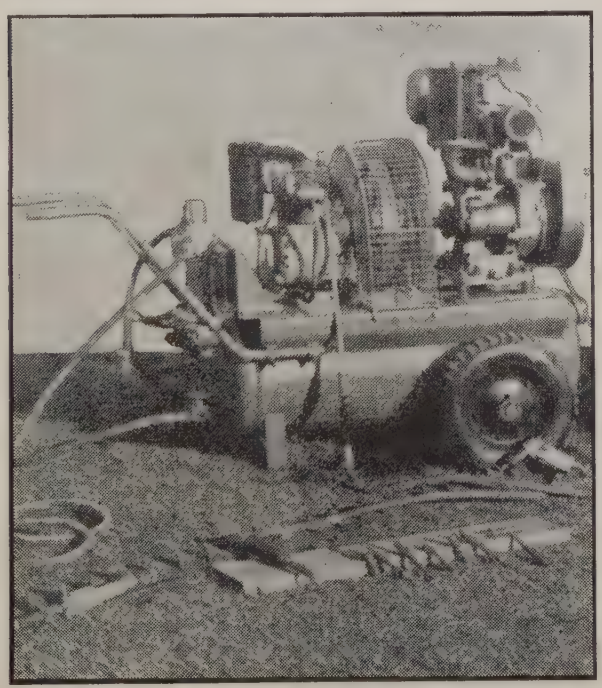
THE low-volume sprayer consists essentially of a boom fitted with special low-volume nozzles to which the spray material is delivered at a low pressure—usually about 30lb. per square inch. The material may be delivered through hoses to the boom in either of two ways: It may be forced from a sealed vessel by compressed air or gas, or it may be pumped from an open vessel.

Air-compressor Machines

Though a low-volume sprayer incorporating an air compressor is much more expensive than that using a pump, a farmer who can make good use of the compressor outside the spraying season would do well to consider it fully before making a choice. An increasing number of farm machines is being mounted on pneumatic tyres, for which the use of compressed air has obvious advantages. Compressed air is an extremely useful adjunct in the spray painting of metal surfaces, and in the farm workshop its uses are legion.

The sprayer using this system of pressurising the material consists of a compressor (driven either by the tractor or by an independent engine) which delivers compressed air to a sealed tank fitted with a large filler plug at the top and an outlet at the bottom, from which the spray material is led to the boom. If the compressor lacks a check valve, one is fitted in the air line between the compressor and the tank. A relief valve and a pressure gauge can be fitted either in the air line or on the tank. A filter and a control valve in the spray line between tank and boom complete the outfit. The tank must be of welded construction to withstand pressures up to 100lb. per square inch, and tanks to withstand this pressure that are over 6in. in diameter must be tested and approved by the Marine Department. The boom fitted to this type of sprayer is identical with that fitted to the pump type.

The tank is about three-quarters filled, the filler plug screwed down to be airtight, and the air compressor set in motion. Excess air pressure is released through the relief valve after the desired pressure has been obtained. The liquid in the tank takes up the same pressure as that shown on the gauge, and opening the control valve releases it to the boom at this pressure.



[*Gas Turbines Ltd. photo.*

An air-compressor type of low-volume sprayer equipped with a single-nozzle hand boom and a range of hand tools, including an air jet, a grinder, a drill, and a range of chisels.

Pump-type Sprayers

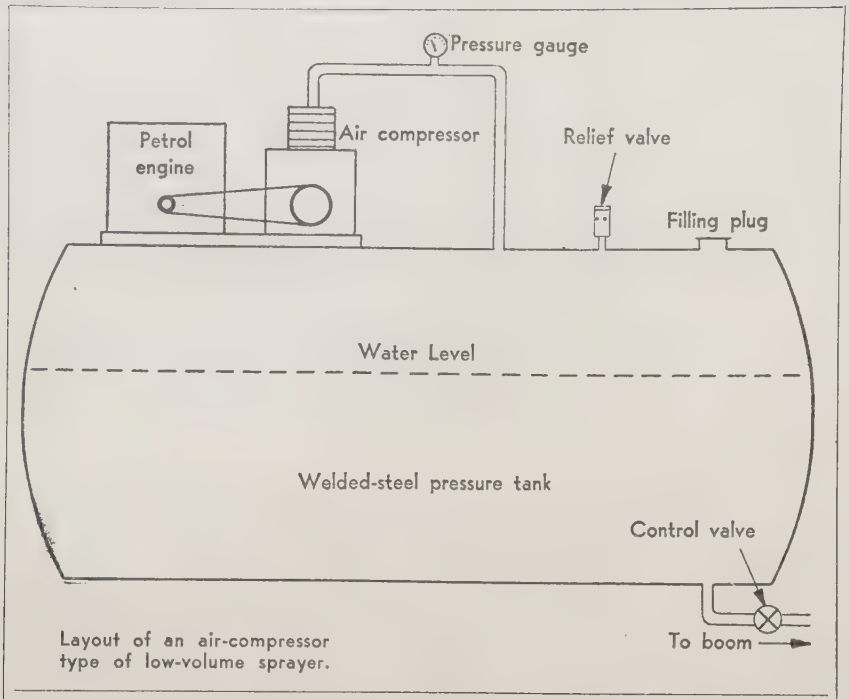
The standard low-volume sprayer using a pump consists essentially of a tank, a filter, a pump, a relief valve, a pressure gauge, a control valve, and a boom in that order, the distance between the units being variable to suit circumstances, but the relationship of one unit to another being fixed. The units are connected by pipe fittings, pipe, or hose as is necessary.

The Tank

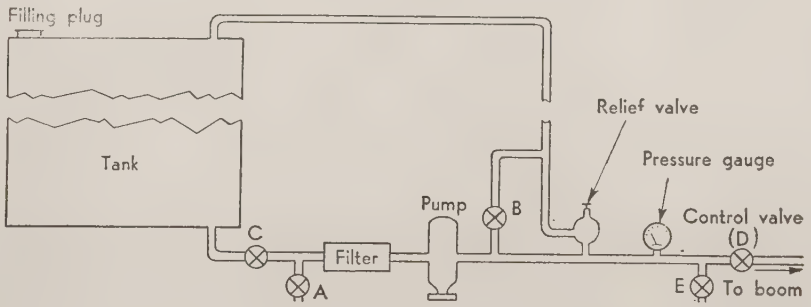
Any container or combination of containers which will hold the required quantity of spray material may form the tank, and usually one or more 44-gallon drums are used. They should be clean and rust free inside and arranged so that each is filled through the large bung. The liquid is usually drawn off from an outlet welded to the bottom of the drum, for this facilitates drainage after the unit has been washed down after use. The overflow from the relief valve is returned to the drum through the small bung at the top, and this overflow is sufficient to keep the spray material mixed. No external or mechanical agitation is needed, for modern weedicides either form a true solution in water or are so finely divided that the particles do not have time to settle between refills of the sprayer.

The Filter

Though only clean, pure water must be mixed with the concentrate for low-volume spraying, a filter between tank and pump is essential to ensure that no abrasive material enters the pump to score it and lower its efficiency. Fitting a gauze filter either in the filling funnel or in the mouth of the filling plug of the tank is a good idea, but a filter should also be placed in the line from tank to pump to make doubly sure that no abrasive material enters the pump. A gear pump, which is almost universally used in this type of sprayer, relies on clearances of the order of thousandths of an inch between the body and the rotors for its pressure and volume output. Any abrasive material entering the pump would destroy these fine clearances and impair the efficiency of the pump.



Layout of an air-compressor type of low-volume sprayer.



Layout of a standard low-volume sprayer incorporating a constant-flow pump and with extra fittings. A is a valve on the suction hose to the water supply and E a valve on a side line to a hand boom. To fill the tank, valves A and B are opened and valves C, D, and E closed. For spraying, valves A and B are closed and valves C and D or E opened.

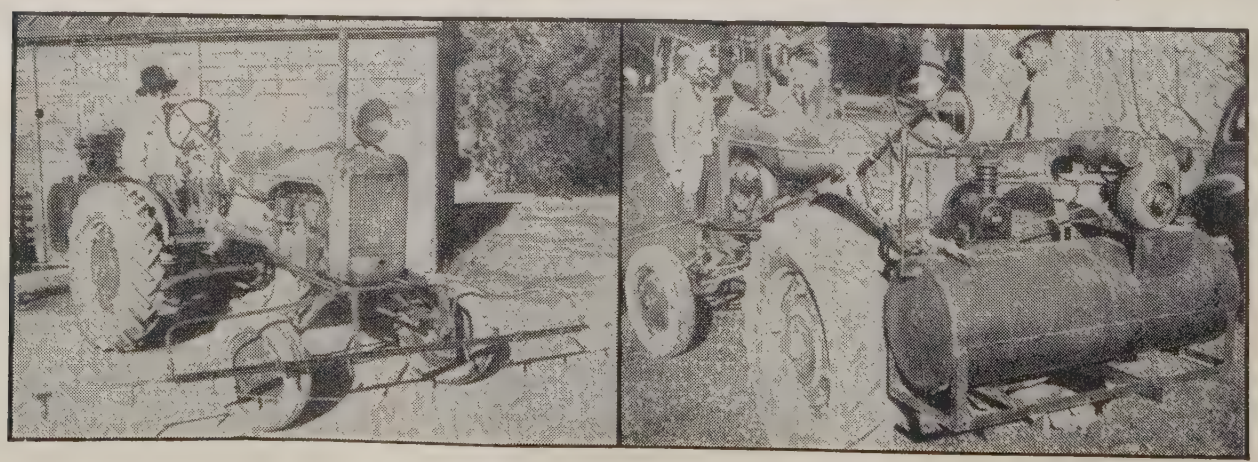
Proprietary filters may be bought or a filter may be made up from pipe fittings as shown in the photograph reproduced on the opposite page. Alternatively, a filter may be made by inserting a cylinder of fine gauze inside the coarse mesh in a steam strainer of the type shown at the bottom of the photograph. Whatever type of filter is selected the gauze should be as nearly non-corrodible as possible (brass or monel-metal wire is recommended) and of 120 to 150 mesh per inch so that it will hold up the smallest particle likely to block the fine orifice of the smaller low-volume nozzles. Some nozzles incorporate a fine-mesh filter, but it is best to rely on these filters to pick up only material sloughed off from the rubber hose and pipe between pump and boom and to depend on the main filter to do the major work.

Type of Pump

Being the prime mover in this type of spray equipment, the pump is all-important and should be selected with care. Any type of positive-displacement pump with sufficient delivery and pressure will do, but a centrifugal pump is unsatisfactory because, in general, though this type has adequate delivery, the pressure developed rarely reaches 15lb. per square inch.

The rotary-gear type of positive-displacement pump is most favoured, being inexpensive and very efficient for its size and cost. It is available in two types: In one the gears run externally to each other, and in the second one gear runs inside another. Gear pumps depend for their delivery on the periferal speed of the rotors and on the width of the face of the rotors; variations of either or both give different deliveries from different sizes of pumps. They depend for pressure on fine clearances between rotors and pump body. Different sizes of gear pumps are known by the size of the pipe fittings which they are tapped to receive; a ½in. gear pump is tapped to take ½in. piping.

The average gear pump as used in water-supply systems is quite suitable for being built into a low-volume sprayer. It is designed to be run at 400 to 500 revolutions per minute (unless the manufacturer recommends otherwise) and, as the power take-off shaft of a tractor turns at about 535 r.p.m. at rated engine speed, this pump can be coupled directly to the shaft.



An air-compressor type of low-volume sprayer can be mounted on a tractor or truck to make an efficient though costly unit that has many uses outside the spraying season.

Such a drive is both economical and efficient. Alternatively, the pump can be driven from the tractor belt pulley and by choice of pump pulley the pump revolutions can be increased to give greater output and pressure. This is sound within reasonable limits, for though the life of the pump is reduced proportionately, its low cost makes the replacement of the pump a few years earlier of little importance. On the whole, however, if increased output is required, it is best to fit a pump of the next greater size.

Size of Pump

A popular New Zealand-made gear pump used in low-volume sprayers is available in several sizes with varying capacities:—

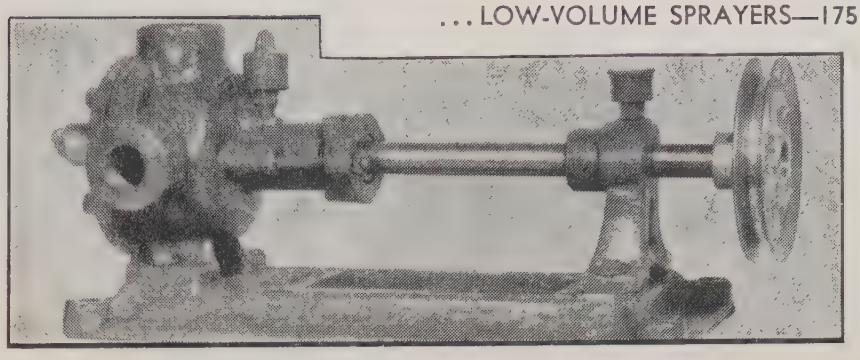
Size of Pump	Delivery (gallons per hour) at 500 r.p.m. At 0lb. per square inch	At 50lb. per square inch
½in. ..	.. 135	90
¾in. ..	.. 150	110
1in. ..	.. 200	140
1¼in. ..	.. 300	—

Allowing a fair margin for return of overflow to the tank for mixing purposes, for long usage (pump delivery decreases with wear), and for the fitting of larger nozzles to the boom, the ½in. pump is suitable for sprayers with 8 to 10ft. booms, the ¾in. pump for 10 to 12ft. booms, the 1in. pump for 12 to 15ft. booms, and the 1¼in. pump for booms 18ft. and longer. All sprayers fitted with a self-filling device need a 1¼in. pump to reduce filling time to the minimum.

The Relief Valve

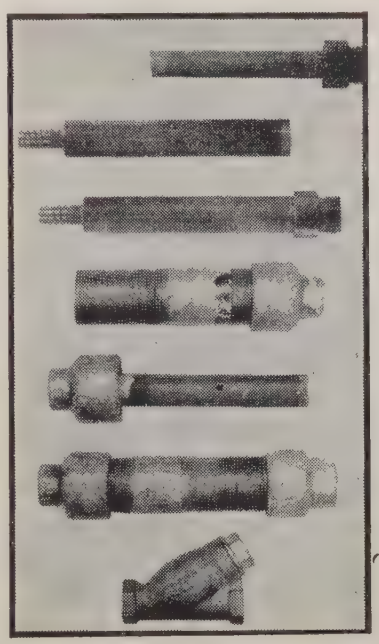
To obviate the pump delivering to the boom more spray than is required and at a higher pressure than is needed a relief valve is fitted into the line from the pump to the boom and excess liquid is returned to the tank through a separate line. A relief valve consists of a housing containing a valve held on its seat by a spring, the tension of which is adjustable externally by a threaded stud. Liquid in the spray line above the desired pressure lifts the valve off its seat and the excess flows through the relief valve to be collected and returned to the tank to act as an agitator and be used again.

In general, the relief valve chosen should have a spring designed for 50 to 60lb. per square inch so that slackening the stud bearing on the spring gives pressures as low as 20 to 25lb. and tightening gives pressures up to 100lb. The average low-volume sprayer works at a pressure of 30lb. per square inch. A relief valve with an external adjusting stud should be chosen. The other type illustrated is set internally to blow off at a certain pressure and has an external lever which lifts the whole valve assembly off its seat and allows the whole delivery of the pump to return to the tank at no head of pressure, but it is not suitable for low-volume spraying, in which different pressures are required quickly for different crops and conditions.



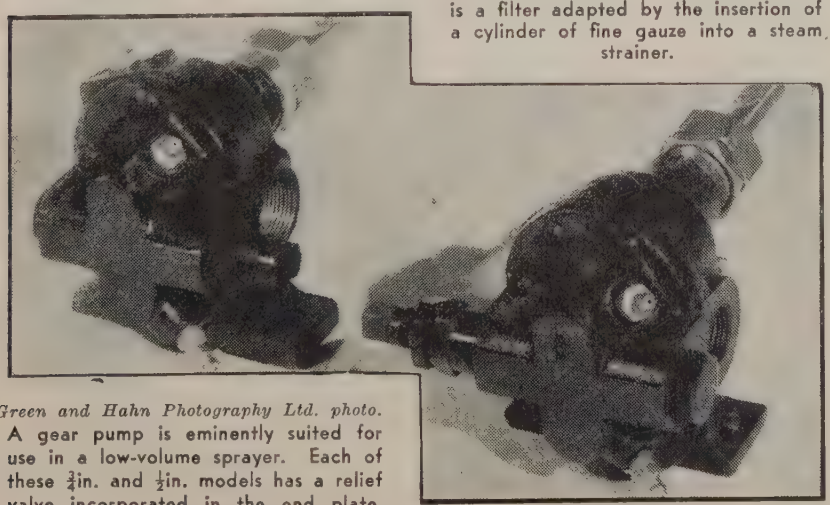
[*Green and Hahn Photography Ltd. photo.*

Another type of gear pump, more suitable for a belt drive, incorporates a pedestal bearing on the pump shaft to obviate wear in the glands and bearings.



[*Green and Hahn Photography Ltd. photo.*

Three types of filter. The top three illustrations show the components of and an assembled commercial filter; the next three are of a filter built up from pipe fittings; and at the bottom is a filter adapted by the insertion of a cylinder of fine gauze into a steam strainer.



[*Green and Hahn Photography Ltd. photo.*

A gear pump is eminently suited for use in a low-volume sprayer. Each of these ¾in. and ½in. models has a relief valve incorporated in the end plate.

A special gear pump designed for use with low-volume spraying plants has a relief valve built into the end plate so that it releases excess pressure from the outlet port of the pump and returns the excess spray material to the inlet port. With such a pump a relief valve on the spray line from the pump to the boom is not necessary.

The Pressure Gauge

A pressure gauge should be fitted in the spray line between pump and boom in a position where it is readily seen by the operator (preferably in front of him). Its face should be 3 to 4in. in diameter so that it can be read at a distance from the sprayer—for example, by an operator using a hand lance on 30ft. of hose for spot spraying or cleaning up awkward corners. The gauge should read from 0 to 100lb. per square inch in 2lb. steps so that pressures can be set and maintained accurately. Gauges reading in 5lb. steps are not easy to read accurately, and pressures can differ considerably from those desired.

The Control Valve

Delivery of the material to the boom is controlled by a valve fitted in the spray line, between tank and boom in a compressor-type machine and between pump and boom in the pump type. The valve can be of the instant shut-off type with which a quarter turn closes or opens the valve, as in quick-acting valves or gas-main cocks, or of the type that is slower in action and is screwed down or up as in gate valves and bib-cocks. In general, the gas-main cock is not recommended, for after a short period of use it develops wear and leaks spray material.

The control valve should be within reach of the operator; if that is not possible, an extended control rod operating the valve should be brought within his reach.

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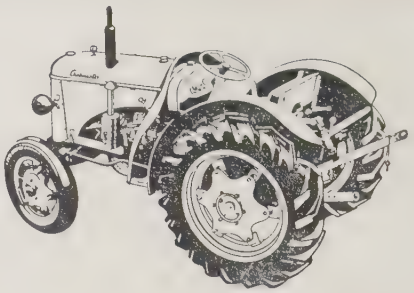

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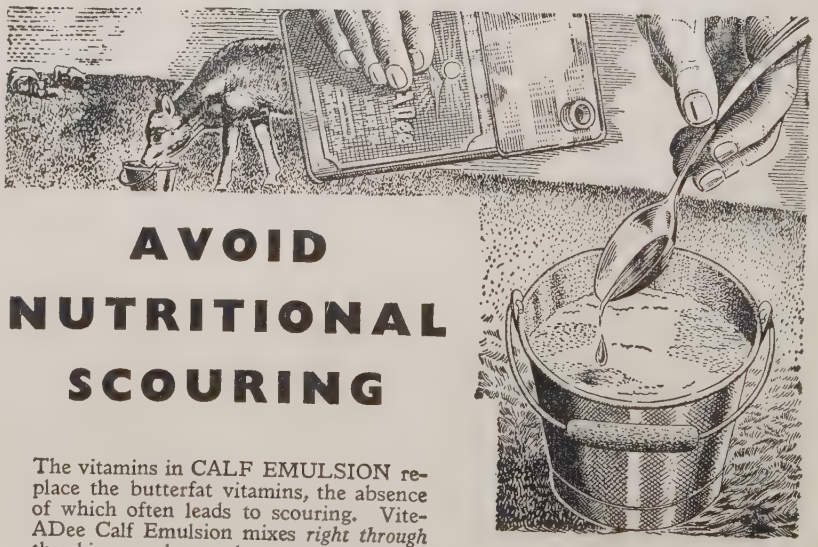

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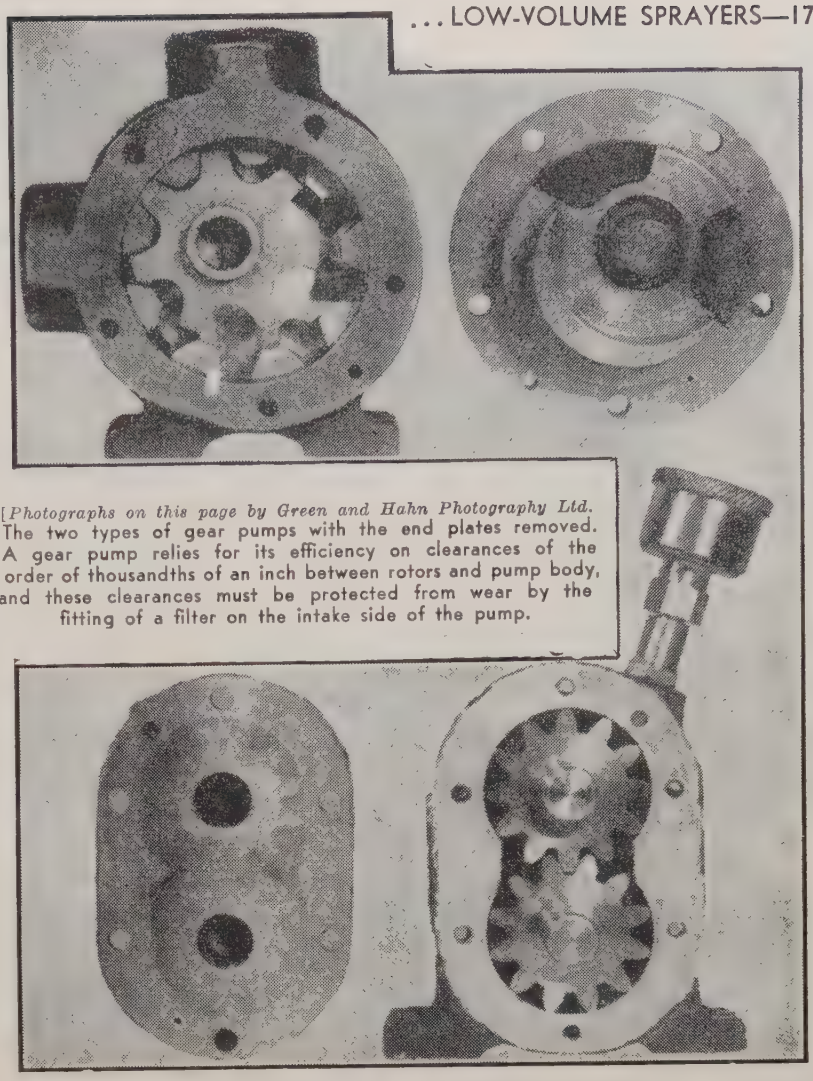
Boom and Nozzles

Essentially a straight tube to which the nozzles are fitted, the boom should be of sufficient diameter (generally 1in. to 1¼in. for long straight booms and ½in. to ¾in. for short lengths as are used in articulated booms) to ensure that the spray material is fed evenly to all the nozzles and that pressure does not drop. It may be built from standard galvanised-iron piping, from steam pipe, or, if resistance to corrosion is desired, from brass or copper tubing. Brass tubing can be obtained in a heavy gauge in standard pipe sizes so that it can be worked similarly to standard galvanised piping.

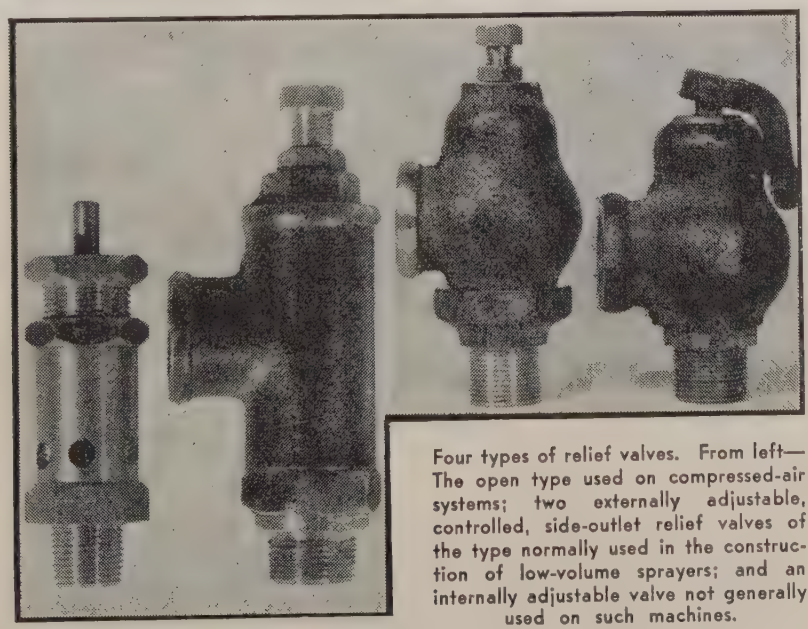
A new polythene plastic tubing which resists corrosion by both acids and alkalis offers great possibilities for boom and spray-line construction and undoubtedly will be more widely used in this field. It is available in standard pipe sizes and can be cut and threaded similarly. By the use of a stream of hot nitrogen two lengths of the plastic can be welded into a continuous length or into a T.

The boom may be made in one straight length or in three lengths hinged together to form an articulated boom that folds upward or backward for transport on roads or through gates. It may be constructed so that it will fold back on impact with an obstruction such as a fence post and not be damaged and will be returned to its working position either by a spring or gravity. Its height should be adjustable to allow for different heights of crops sprayed, either by its being clamped to posts at different heights or by a system of ropes and pulleys.

Nozzles should be screwed into sockets bronzed directly on to the bottom of the boom, into an inverted U tube, or into a side elbow bronzed on to the boom; the first fitting is used almost universally. The socket is usually of brass and, as the nozzles are also brass, a brass-to-brass fitting is obtained that makes for easy removal of the nozzle and minimum damage to the thread. All low-volume nozzles and their adapters sold in New Zealand have a ¼in. gas male thread, so a ¼in. socket takes all nozzles.



[*Photographs on this page by Green and Hahn Photography Ltd.*
The two types of gear pumps with the end plates removed. A gear pump relies for its efficiency on clearances of the order of thousandths of an inch between rotors and pump body, and these clearances must be protected from wear by the fitting of a filter on the intake side of the pump.



Four types of relief valves. From left—The open type used on compressed-air systems; two externally adjustable, controlled, side-outlet relief valves of the type normally used in the construction of low-volume sprayers; and an internally adjustable valve not generally used on such machines.

With the realisation that the large quantity of water in a weak solution of weedicide acted merely as a spreading and dispersing medium the way was opened for low-volume spraying, and the development of the low-volume nozzle in the United States of America in recent years made the system possible. The only essential was that the required quantity of active weedicide had to be spread evenly over the area, and when that could be accomplished with small quantities of water at low pressures there followed a great saving in capital outlay on plant and in time and work needed for spraying. Whereas previously large quantities of water had to be hauled to and sprayed over fields at rates as high as 100 gallons per acre, weeds could now be eradicated by spraying a concentrated solution of weedicide at rates as low as 2 to 5 gallons per acre. In practice, rates of about 10 gallons per acre are used for weeds in crops and pastures.

Because of its accurate machining the low-volume nozzle at low pressures delivers through a fine orifice a spray of small particles of relatively even size and density in the shape of a fan or a solid or hollow cone as desired.

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For effective and efficient weed control, the most economical hormone weed killers are:

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Use Stantox 64 to combat weeds in crops, such as fathen, Shepherd's purse, wild turnip and buttercup. Stantox 64 eliminates weeds easily, quickly.

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. . . used for pasture-spraying . . . to control thistle and other difficult-to-kill weeds.

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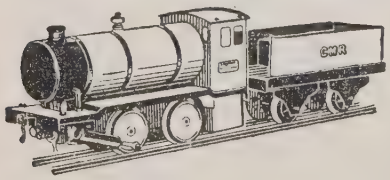

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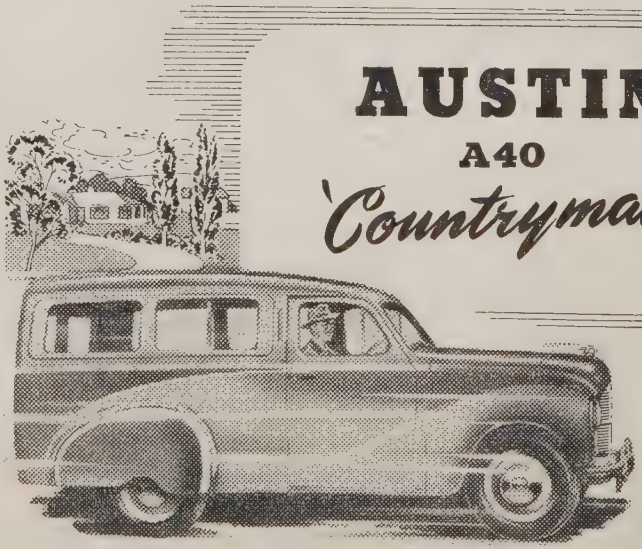

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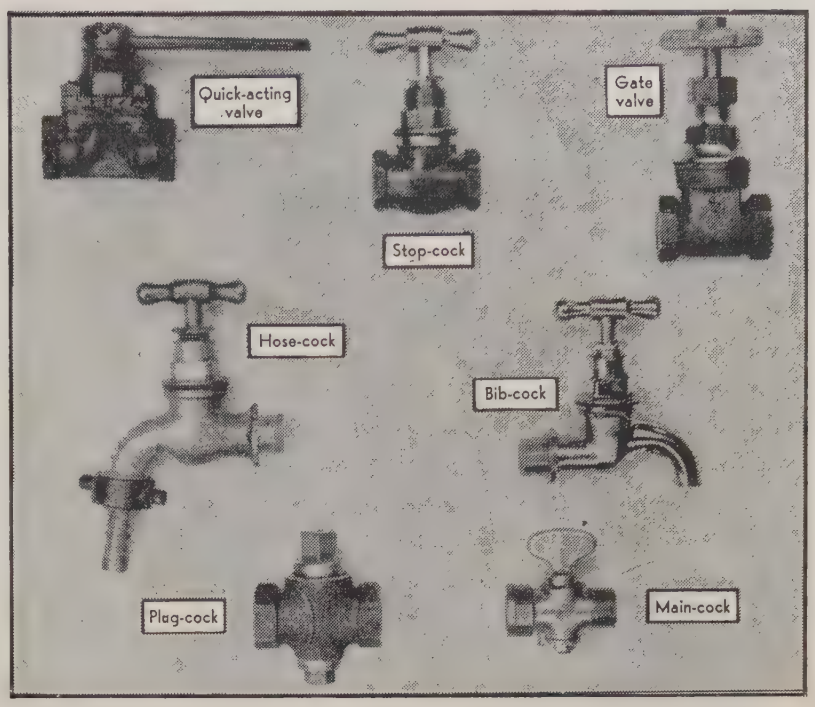
That most widely used for weed control in pastures and crops sprays in the shape of a fan.

The nozzles are made of brass, and a nozzle of any one make has a range of tips of different deliveries which are interchangeable, enabling any desired spray pattern or rate of spraying to be obtained by merely changing the tip in the nozzle. Increasing the pressure in the boom increases the rate of delivery from the nozzles, and the pattern of spray alters because the particles become smaller and more finely divided. The finer spray is more subject to wind drift and less able to penetrate into herbage, so the rate of application should be increased by changing to a larger tip. The largest tip gives a spray containing large particles and is suitable for spraying into herbage where deep penetration is desired, but as coverage of the herbage is reduced, alternating large and small tips across the boom and operating at higher pressures has been found effective; the larger tips give a penetrating spray while the smaller give a fine, fog-like spray that swirls into the herbage to complete the coverage.

The "Agroxone" nozzle incorporates a moulded ceramic tip in a brass housing and sprays in the form of a fan. The orifice, being moulded in porcelain, resists corrosion by both alkalis and acids and will maintain both its delivery rate and spray pattern. It is suitable for use not only with the hormone weedicides but also with corrosive materials such as sulphuric acid, which can now be sprayed by the low-volume method. Concentrated solutions of sulphuric acid are less corrosive to the spray plant than are the weaker solutions sprayed at high volume.

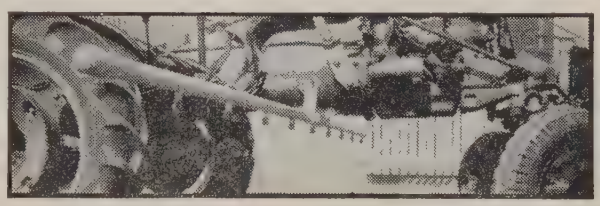
Most low-volume nozzles incorporate a filter to prevent the fine orifice becoming blocked with material suspended in the spray. The filter is removable for cleaning, and the fine gauze is usually made of a non-corrodible wire such as monel metal.

Some nozzles also have a non-drip valve, which usually consists of a spring-loaded, stainless-steel ball bearing in contact with its valve seating; the spring usually allows the valve to open at a pressure of 10lb. per square inch for spraying at normal pressures, but when the boom control valve is closed the nozzles continue spraying until the pressure in the boom drops to 10lb. per square inch, when the valve closes to prevent nozzle drip and keep the boom full of spray material until it is used again. Such a valve is not commonly used in New Zealand, but is of great value in the field to prevent nozzle drip when a stop is made for refilling or an adjustment, as it not only protects the crop from an overdose of weedicide but also saves valuable spray solution. If a non-drip valve is not supplied fitted inside the nozzle, it may be built in a separate unit which is fitted between nozzle and boom.

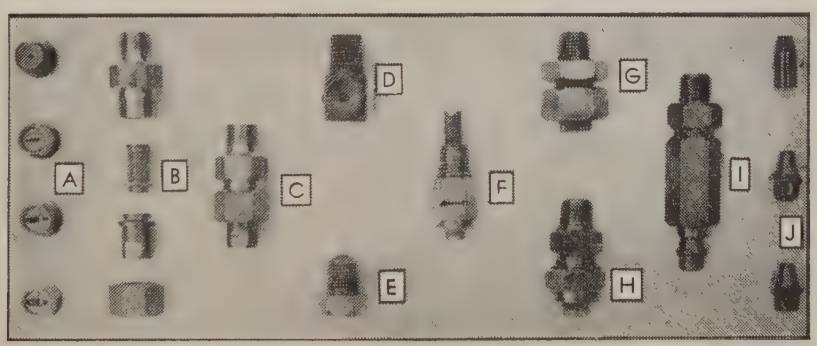


[*Green and Hahn Photography Ltd. photo.*

Seven types of control valves. Any of the top three is suitable for use on a low-volume sprayer, but the bottom two are unsuitable because they soon wear and start to leak.



A straight boom fitted under a row-crop type of tractor. The nozzles are screwed into sockets bronzed on to the boom.



[*Green and Hahn Photography Ltd. photo.*

Several makes and types of nozzles commonly used on low-volume sprayers in New Zealand. All but one have removable tips so that only a change of tip is necessary to alter the spraying rate. A—Four different sizes of tips for "Monarch" nozzles. B—A "Monarch" nozzle broken down to show (from top) the body, filter, tip, and retaining cap. C—A "Monarch" nozzle complete. D—A wide-angle, high-delivery "Airplane" nozzle. E—An older type of "Monarch" nozzle without a removable tip. F—A "Delavan" nozzle with non-drip valve incorporated in the body. G—An older type of "Tee Jet" nozzle. H—A "Tee Jet" nozzle of the latest type. I—An "Agroxone" ceramic-tipped nozzle with non-drip valve incorporated in the body. J—Three sizes of "Agroxone" tips.

Another method of preventing nozzle drip is to fit the nozzle to an inverted U tube which is mounted on the top of the boom. When the supply of spray to the boom is stopped the nozzles continue spraying until the pressure drops to nil, when the nozzles will stop dripping and the boom will remain full to the tops of the U tubes.

In theory it is possible to reverse the intake and delivery lines to the pump so that spray material is drawn back from the boom when a stop is made in the field, so preventing nozzle drip, but in practice air enters one nozzle and destroys the suction of the pump so that the other nozzles start to drip. A venturi tube with by-pass operated by the delivery of the pump has been

despite its condition

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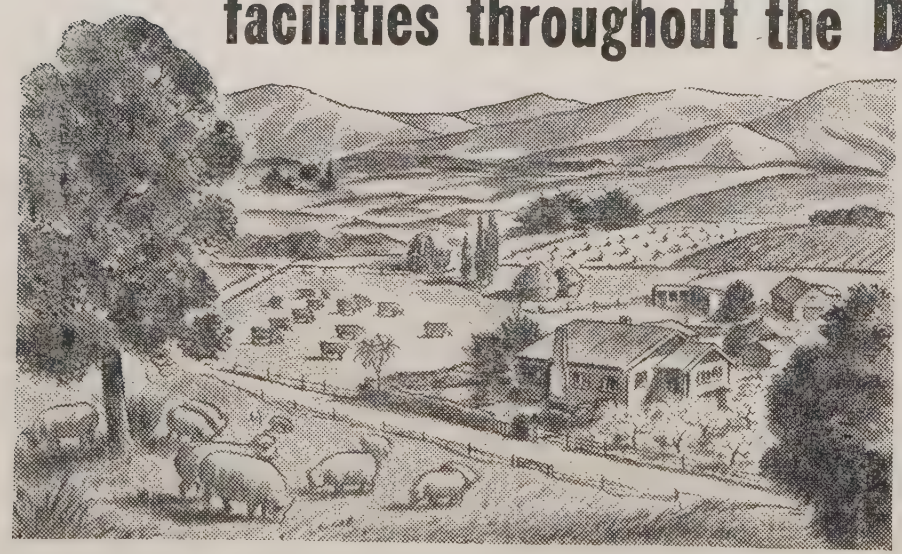

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used for this purpose with some success, but its use is not widespread.

Great care should be exercised in cleaning a nozzle should a blockage occur, for the fine orifice can be damaged easily, with resultant deterioration in the discharge rate and the spray pattern. A toothbrush, but never a piece of fine wire or a pin, should be used to clear a nozzle. A good plan is to wash each nozzle regularly to remove scale which results from evaporation of the spray material and, building up around the orifice, distorts the spray pattern.

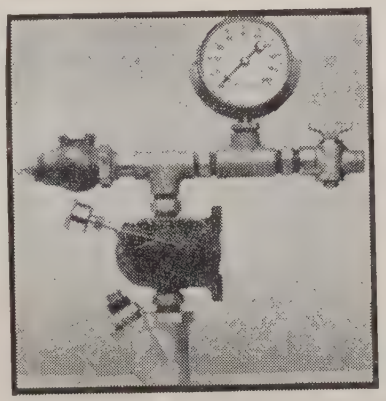
Delivery rates of low-volume nozzles in common use in New Zealand at different operating pressures are shown in the table below. Boom output can be calculated for a set of any one size or combination of sizes of nozzles by reference to the section on calibration which is to appear in the concluding part of this article in next month's "Journal".

Spray Lines

Filter, pump, relief valve, pressure gauge, and control valve are usually built into a compact unit by the use of pipe fittings as in the illustration on this page. The spray lines connecting the tank to this unit and the boom can be built up from standard water pipe or ordinary garden hose, either rubber or plastic, as desired; all will withstand a pressure of 100lb. per square inch, which is about the highest used in a low-volume sprayer. Hose is useful if the spray line must be taken round awkward corners. Constriction in the spray line must be avoided, as it will reduce the flow and pressure of the spray material. The usual cause of constriction is the use of hose adapters when changing from pipe to hose in the spray line, especially where the hose is ½in. plastic. A larger hose slipped directly over the pipe is better than a hose adapter or fitting; ¾in. hose fitted over ½in. pipe or 1in. hose over ¾in. pipe makes an efficient joint that offers no obstruction to the flow of spray material. Loss of pressure in the short spray line used will be negligible if ½ or ¾in. fittings are used.

Where resistance to corrosion is desired, brass or copper tubing may be used instead of galvanised pipe, but if the machine is washed out thoroughly after use no corrosion will result from the use of modern hormone weedicides. However, the older weedicides—arsenicals, sulphates, and chlorates—are corrosive if left in contact with ironware.

A hand boom is a useful fitting for spraying such places as hedgerows, drain banks, under fences, and behind buildings which cannot be reached by the big boom.



[*Green and Hahn Photography Ltd. photo.*

A neat arrangement of filter, pump, relief valve, pressure gauge, and control valve may be built with pipe fittings. A stop-cock is preferable to the main-cock shown in this illustration.

LOSS OF PRESSURE IN 100ft. OF PIPE (pounds per square inch)

Flow (gallons per hour)	Diameter of pipe ½in.	¾in.	1in.
60	0.91	—	—
120	3.22	0.82	—
180	6.85	1.78	0.55
240	11.7	3.04	0.93
300	17.78	4.61	1.41

Adapted from "Power Farming in Australia and New Zealand".

Other Fittings

The pieces of equipment discussed are the essential parts of a low-volume sprayer, but the machine may be improved and made more efficient by the addition of one or more of the following fittings.

Hand Boom

For spot spraying weeds where they are so sparse as not to warrant the use of the big boom fitted to the sprayer a hand boom will be found very useful. It can also be used for spraying drain banks, under fences, around sheds, and in awkward corners where the big boom cannot penetrate, and for treating brush vegetation which is too high or irregular for the normal boom. A hand boom on a long hose can be used for cleaning up patches of weeds on steep faces inaccessible to the tractor.

The hand boom consists of one, two, or three nozzles fitted to a cross-head or straight head, which is mounted on a straight length of piping, usually of ¼ or ⅜in. diameter for lightness. A length of hose carries the spray material, the supply of which is controlled by a valve. By fitting a T in the spray line between pump and boom and sealing this side line with a stop-cock, as in the diagram on page 174, a permanent fitting is made for the hand boom, which can be used at will without interference to the big boom.

RATED DELIVERIES OF LOW-VOLUME NOZZLES IN COMMON USE IN NEW ZEALAND

"Agroxone" Nozzles: Delivery at 4 m.p.h. and Pressure of 30lb. per square inch

Jet	Delivery per nozzle (gallons per hour)	Spraying rate per acre for a boom with nozzles spaced 12in. apart	18in. apart
"Agroxone" jet	4.51	9.6	6.4
217/00	8.16	17.28	12.1
217/0	13.15	28.1	18.74

"Tee Jet" Nozzles: Delivery at 4 m.p.h. and Pressure of 40lb. per square inch

Tip No.	Boom height	Distance apart of nozzles	Gallons per acre
650067 ..	18in.	18in.	5.0
65015 ..	18in.	18in.	10.7
6503 ..	18in.	18in.	21.4
730077 ..	20in.	20in.	5.0
730154 ..	20in.	20in.	10.0
730308 ..	20in.	20in.	20.0
8001 ..	17in.	20in.	6.4
8002 ..	17in.	20in.	12.8
8004 ..	17in.	20in.	25.6

"Monarch" Nozzles: Delivery per Nozzle in Gallons per Hour

70-degree fan tip No.	Pressure in pounds per square inch 20	25	30	40	60	100	200
20	—	—	1.75	2.55	3.1	4.0	5.75
22	—	—	2.9	3.35	4.15	5.25	7.6
25	3.2	3.4	3.8	4.25	5.3	6.75	9.65
28	3.4	3.9	4.15	5.0	6.25	7.75	11.3
32	4.9	5.25	6.0	6.5	7.55	10.0	15.0
35	6.0	6.6	7.15	7.9	10.0	12.5	17.5
39	7.6	8.8	10.0	11.3	14.15	18.3	26.1
46	10.0	11.25	12.5	13.8	16.65	21.65	31.65
59	17.5	20.0	22.5	25.0	30.8	40.0	55.0

A hand boom is available commercially with a swivel head that can be set across or straight, and another type has a narrow head designed to penetrate bushy and viny herbage and spray the innermost parts.

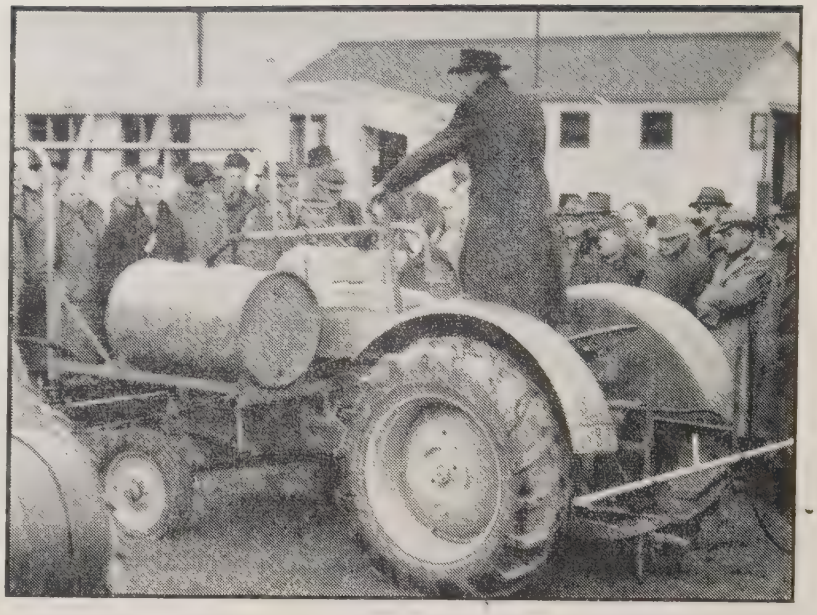
Self-filling Device

If two tanks are fitted to the sprayer to reduce travel for refilling when spraying fields distant from the water supply, filling two 44-gallon drums by hand will be found arduous and time consuming. The sprayer may be made to fill itself by fitting a hose to a side line on the suction side of the pump and a line by-passing the relief valve and controlled by a stop-cock to deliver the water to the tanks; this layout is also shown in the diagram on page 174.

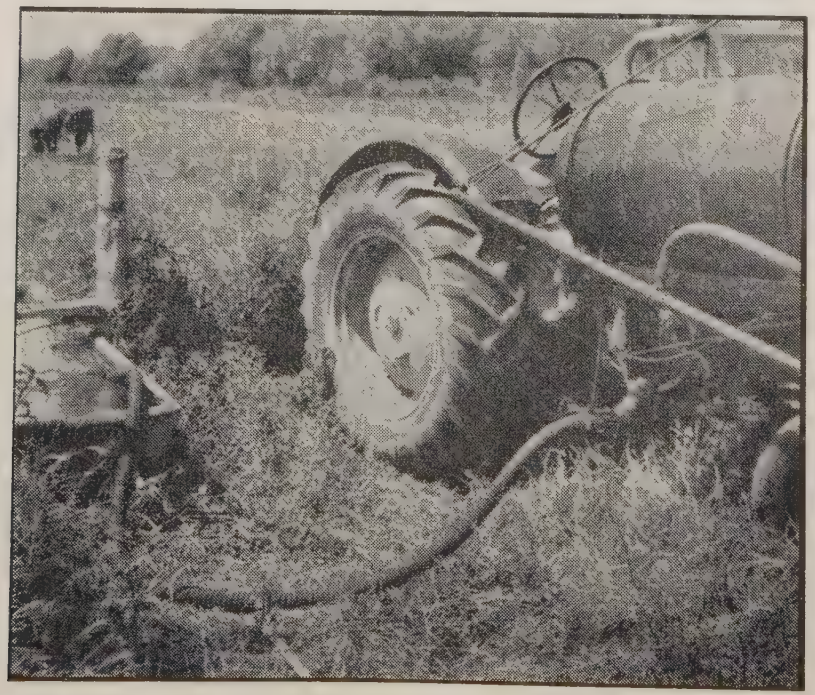
The sprayer is usually fitted with a larger pump to reduce the filling time. A 1¼in. pump delivers about 300 gallons per hour and will fill two 44-gallon drums in about ¼ hour. Under average spraying conditions two 44-gallon drums will carry enough material to spray 8 to 11 acres non-stop before refilling is needed.

Speedometer

A tractor-mounted low-volume sprayer operating on level fields will maintain a fairly constant speed because of the self-governing motor, but on rolling country engine revolutions will fluctuate as the machine goes uphill and downhill, with corresponding changes of speed. This leads to fluctuations in the amount of material sprayed per acre and perhaps to the difference between a partial and a complete kill. Under such conditions, and especially when the sprayer is fitted to a vehicle, such as a farm truck, with a non-governed engine, a special low-reading speedometer is an invaluable aid. The average car or truck speedometer is not accurate in its lower ranges, but speedometer specialists can make at reasonable cost special units for tractors which are accurate up to 10 miles per hour.



The Department of Agriculture's low-volume sprayer attracted much interest at a display of spraying machinery at Canterbury Agricultural College, Lincoln. The machine is fitted with a folding, front-mounted 18ft. boom for field work, a rear-mounted 6ft. boom for experimental work, and a hand boom for spot spraying.



If large quantities of water are carried on the sprayer, a self-filling device reduces the time and labour required for replenishing the machine.

With accurate control over speed and pressure, an operator has accurate control over the amount of material sprayed per acre and under suitable conditions can reduce the amount of active ingredient and still obtain a complete kill. The resultant saving in cash will soon pay for the speedometer. Though ½lb. of 2, 4-D acid equivalent per acre is usually recommended for killing wild turnip and fat-hen, under favourable conditions and in the seedling stage they can both be killed with ⅜lb., with a saving of about 7s. 6d. per acre. Sufficient would be saved on a 20-acre field to buy the speedometer necessary for such fine work.

Special Booms

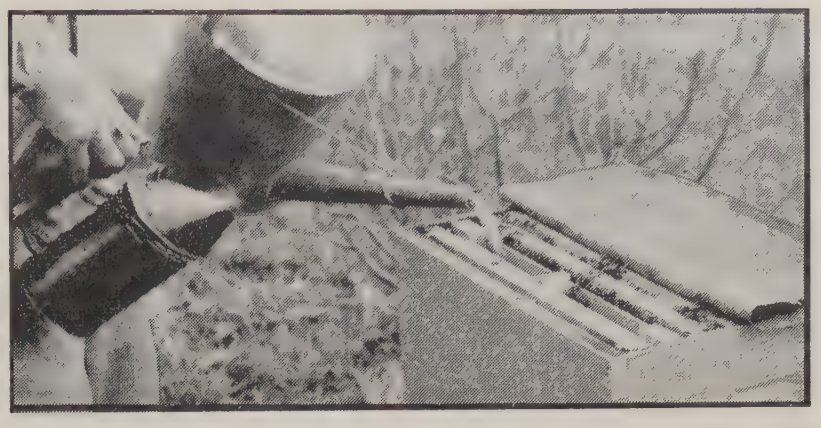
If the main boom is made in three parts which fold for road travel or negotiating obstacles, it is sometimes useful to have the spray line to the boom split with a cross into three separate lines, one to each section, and have each line controlled by a stop-cock, the whole boom being controlled by a master stop-cock in the main line. This arrangement enables the operator to shut off delivery to the centre boom and one outer boom and, by driving along a drain bank, to spray only the weeds in the drain with the other outer boom.

Such an arrangement is also useful to spray weeds growing in hedgerows, such as Californian thistle in a gorse hedge. One outer boom (usually a short one mounting two or three nozzles) is arranged vertically to give coverage from the ground to the height of the hedge. Long distances of hedges can be treated in a day by driving along the hedgerows. The heading photograph of this article shows a sprayer with a boom fitted in this manner.

Early-spring Care of Bees and Hive Equipment

Seasonal Notes for the Domestic Beekeeper

AS the days lengthen and grow warmer bees require more frequent attention. This article by S. Line, Apiary Instructor, Department of Agriculture, Invercargill, discusses work the domestic beekeeper should do during early spring in caring for his bees and hive equipment.



A division board feeder placed close to the brood nest and being filled with sugar syrup.

WITH increasing activity among the bees in spring it is necessary to have the right tools on hand, a hat and veil that are bee-proof, and clothes that are not woolly or fluffy, for this will excite bees to attacking the beekeeper, especially around the ankles. Makeshift tools such as screw-drivers and chisels that are sometimes used in hive manipulation are not recommended, as they tend to bruise the edges of supers and take an unsatisfactory grip or leverage of frames. Flat files may be used, but unless some of the temper is removed by heating, they may snap in the hands when used for levering. The serrated or grooved surface of a file is also a source of danger, because it harbours dirt, and as the spread of disease, particularly "foul brood", has always to be guarded against, the use of any tool without a smooth surface is not recommended.

Repairs to Smoker

The smoker is such an indispensable article that any repairs delayed during the winter and needing the attention of a leather worker or welder should be attended to. During the past year new smokers have been difficult to buy. If the air hole from the bellows to the smoke box blocks, it can be cleared with the hook end of a Pender hive tool.

Half-rotted or perished sacking is probably the most popular material for using in the smoker, but pine needles are often used, though they have the disadvantage of not maintaining a hot heart and of burning out more quickly than sacking. A dense, white smoke can be produced from the autumn fall of oak leaves.

Importance of Suitable Clothing

The experienced beekeeper is not usually troubled with bee stings, but those who are should give some attention to suitable clothing. Overalls of a smooth material, of a neutral or dull colour, and of such length that they will fall well over the boots or shoes are popular. For the protection of the arms a pair of canvas gauntlets can be made; these should be fitted with elastic to keep the material close to the wrist and the elbow. It is not desirable to wear gloves any longer than is necessary to get over nervousness in the initial stages of beekeeping, for with gloves the manipulation of frames is difficult and cumbersome. Scent on the person may cause bees to rise suddenly up to the bee veil and possibly get underneath it to attack the face and neck. Bees object to scent, and the use of hair oils, etc., should be avoided when working with bees.

At this period of the year bees will be observed landing on the alighting board with baskets or pellets of pollen attached to their legs and generally showing considerable activity during warm days. At this time much more honey is being used up in rearing brood than is being brought into the hive, and it is essential to ensure that stores of honey will carry the hive through a spell of bad weather.

The general condition of the brood should also be observed. While the area of the brood nest is relatively small opportunity should be taken to watch for an odd cell that has a capping of a darker shade, a damp, oily look, or even a slight depression with a pin-point puncture. Any such cappings should be pricked off with a straw or twig; discoloured larvae are an indication of disease, the nature of which should be determined quickly.

Feeding Syrup

Where all the brood appears free of disease it may be desirable (if the hive feels light) to feed the bees with a sugar syrup so that an average of 5 or 6 combs will contain either honey or syrup. In spring a syrup composed of equal parts of sugar and warm water should preferably be fed to the bees in the evening. Hive entrances then should be reduced to about 2in. The method of feeding should be that which supplies the greatest bulk in the shortest time, as this will reduce excitement and any tendency to start robbing. Two feeding methods are illustrated.

At this time of year, while the colony is relatively small, it is desirable to replace parts of the hive affected by dampness or by mice. If extra mats and some good combs are available, they should be used to replace wet mats and faulty combs within the brood nest.

Photographs by Commercial Studios.

Method of feeding bees by using a glass or tin container inverted over a hole in the hive mat.

Christmas Gift Subscriptions

To avoid late delivery caused by the congestion of Christmas mails, gift subscriptions to the "Journal" should be paid to the nearest office of the Department of Agriculture not later than Friday, November 30.

Care of Livestock during October

Contributed by the Animal Research Division

CATTLE TICK CONTROL

WHERE cattle ticks are plentiful spraying or dipping should be carried out in November and December to prevent tick worry and kill the adult female ticks before they lay their eggs.

BLOWFLY STRIKE IN EWES

In districts where crutch strike causes trouble in ewes crutching or early shearing is advised. Close supervision is necessary to detect cases so that suitable treatment can be applied before the strike becomes too extensive. When treating cases of fly strike shear the wool away to leave 1in. margin of clean skin around the affected area. Remove the maggots by tapping the area with the shears and apply some reliable non-irritant dressing. Irritant fluids such as kerosene tend to cause restrike.

BLACK DISEASE VACCINATION

In the east coast areas of the North Island where black disease of sheep occurs vaccination should be carried out during November or early December. This will protect the sheep against the disease, which occurs mainly in summer and autumn. Vaccine should be ordered immediately.

BLOOD POISONING FOLLOWING SHEARING

Deaths in sheep following shearing may be caused by infection of cuts or bruises with the blackleg germ. This disease can be prevented by vaccinating at least 3 weeks before shearing. Sheep which have been vaccinated previously may not require re-vaccination, and a Veterinarian or Inspector of Stock should be consulted about the best procedure.

BLACK-HEAD IN POULTRY

Young turkeys and poultry are affected by black-head disease and it can best be prevented by rearing the birds on land which has not been contaminated by adult poultry. If an outbreak occurs, kill all affected birds and move the remainder to clean ground. In the event of a bad outbreak the local Poultry Instructor of the Department of Agriculture should be consulted, as in some cases treatment may prove beneficial.

GREENLEG IN BROODER CHICKENS

Greenleg in brooder chickens occurs in poorly ventilated brooders, especially if they are over-crowded and damp. At the first sign of trouble the necessary measures should be taken to ensure that ventilation is adequate and the litter is changed if it is at all damp.

ROUND WORMS IN POULTRY

Infestation by round worms is one of the most important causes of poor development of young birds. All growing stock should be treated twice with carbon tetrachloride, once at 3 months old and again at 5 months.

SUPPLEMENTARY FEED

Supplementary feed is essential to ensure the proper feeding of cows in winter and in dry summers and to control facial eczema in autumn. As soon as more pasture is available than is necessary to meet the immediate needs of stock, the balance should be shut up for silage or hay. On a well-managed dairy farm it should be possible to shut up at least 40 per cent. of the pasture. Crop growing for fattening of weaned lambs is standard practice in South Island districts, and it could with advantage be adopted more widely in North Island districts which experience a dry summer. Crops such as thousand-headed kale and turnips in addition to providing excellent fattening feed for lambs are a splendid insurance against facial eczema. In Poverty Bay and Hawkes Bay they should be sown before the end of October so that they can be well established before dry weather sets in.

Correct docking reduces susceptibility to crutch strike.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during July and for the 12 months ended July 31, 1951, with comparative figures for the same month and 12-monthly period of 1950, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

Period	Creamery	Tons Whey	Total	% Inc. or dec.	Total tons in store at end of mth.
July, 1951 ..	1,527	7	1,534	—	11,976
July, 1950 ..	1,464	13	1,477	—	6,070
Inc. or dec. ..	+63	—6	+57	+3.859	+5,906
For 12 mths. to 31/7/51 ..	150,638	3,033	153,671	—	—
For 12 mths. to 31/7/50 ..	142,639	2,913	145,552	—	—
Inc. or dec. ..	+7,999	+120	+8,119	+5.578	—

CHEESE

Period	White	Tons Coloured	Total	% Inc. or dec.	Total tons in store at end of mth.
July, 1951 ..	156	—	156	—	9,793
July, 1950 ..	213	12	225	—	7,644
Inc. or dec. ..	—57	—12	—69	—30.666	+2,149
For 12 mths. to 31/7/51 ..	102,943	1,526	104,469	—	—
For 12 mths. to 31/7/50 ..	78,869	21,584	100,453	—	—
Inc. or dec. ..	+24,074	—20,058	+4,016	+3.997	—

If these figures are converted into butterfat equivalent, there is an increase of 5,207 per cent. in butterfat graded for the 12 months as compared with the corresponding period of the preceding season. It should be noted that the above figures refer only to butter and cheese graded for export, and that owing to diversions which may take place from time to time, they are not necessarily a true indication of production trends.

Silage Making and Topdressing: Spraying Gorse and Blackberry

SEASONAL NOTES Contributed by EXTENSION DIVISION

WITH THE ADVENT of more efficient mechanical appliances for harvesting (particularly the buck rake and forage harvester), silage making is resuming its earlier importance on North Island dairy farms. In addition to the essential feature of fodder conservation, silage making has much to commend it for its contribution to pasture management, as early closing and early ensiling provide an excellent pasture aftermath useful for late-December and early-January feeding. This aftermath from an ensiled field can be stimulated greatly by topdressing the field immediately after it has been harvested.

BUCK RAKE Though generally similar to the conventional front-mounted tractor sweep, the buck rake is fitted to the rear of a tractor equipped with 3-point hydraulic lift. The tractor is backed along a windrow until a load is obtained, the load lifted clear of the ground, and a smart run made to the stack or pit. The buck rake makes for very fast moving of the cut material from field to stack or pit and is proving popular with silage makers.

THE FORAGE HARVESTER The purpose of the forage harvester is to cut a standing crop, chop the material, and blow it into a trailer either hitched behind or drawn alongside. The length of the chopped material can be varied, but a setting which gives lengths of from 2 to 4in. has generally been found most suitable. If the material is cut too short, it is hard to fork. Forage harvesters have proved very useful for making pit silage. With one man operating the harvester, one hauling the trailers from the field to the pit, and another at the pit, a crew of three men can harvest large areas of silage.

* * *

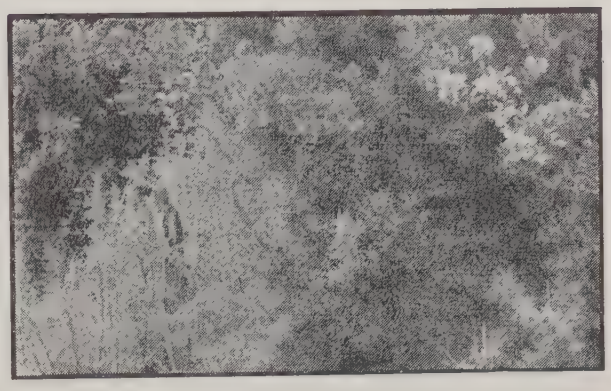
TOPDRESSING IN NOVEMBER EARLY ENSILED FIELDS normally produce a white clover aftermath which is particularly valuable as feed in late December and early January, and the aftermath growth can be stimulated greatly by a topdressing in November. Apart from the difficulty of obtaining labour for the work, November is a very suitable month in which to topdress. On farms where only one application is made each year March-April is probably the most suitable period in which to apply phosphatic fertilisers, but where two topdressings are given (and this practice has much to commend it even if the total phosphate application is not increased) March-April and November are best.

* * *

TRIALS WITH TIMES CF TOPDRESSING TRIALS carried out by the Extension Division have shown that superphosphate takes about a month to affect pasture growth and that the maximum effect is obtained 2 to 3 months after application. Trials at Ruakura showed that December applications of superphosphate produced 20 to 30 per cent. more pasture growth from January to April inclusive than did applications in March, and in corresponding trials at Marton the same effect was obtained, but the extra growth period extended to May and the margin was increased to 25 to 40 per cent.

* * *

CONTROL OF GORSE SEEDLING GORSE before the flowering stage is quite susceptible to the ester preparation of 2, 4, 5-T. Physiological resistance to 2, 4, 5-T increases as the plant matures, "old-man" gorse being resistant under adverse climatic conditions. Gorse past the stage at which the bark on the stem has begun to turn brown should be burnt or cut and the regrowths treated with 2, 4, 5-T. Results will be disappointing if the regrowths from old root stocks are treated too soon after the plants have been burnt or cut;



Gorse treated with 2, 4, 5-T and untreated plants.

it is best to wait until the regrowths are approaching the flowering stage. The best time for applying the spray is November to February. Rates of application vary for different growth stages, a concentration of 1 : 500 to 1 : 1000 in water being sufficient for seedling gorse under correct conditions. Regrowth gorse requires a concentration of 1 : 300 to 1 : 500 in water. More important than rate of application is a complete spray cover of the foliage and stems. The volatile esters of 2, 4, 5-T are a distinct aid in this direction, but should not be used near susceptible vegetation of value.

* * *

CONTROL OF BLACKBERRY SPECIES of blackberry offer different degrees of resistance to 2, 4, 5-T, *Rubus fruticosus* being the most resistant type. Repeat sprays are necessary to eradicate any species. The time of application is critical, late summer and early autumn being best. Regrowths quickly follow spring and early-summer applications, and blackberry appears resistant to winter treatments. Rates of application depend on the maturity of the canes. First-year canes require a concentration of 1 : 500 to 1 : 1000 and older bushes containing a mixture of first- and second-year canes a concentration of 1 : 500 in water. In all cases the slower the check to foliage and canes in reaching ground level, the fewer regrowths will result. These regrowths should be treated in late summer or early autumn of the year after the original treatment, when good control may be expected. As with gorse, complete spray cover of blackberry foliage and stems is essential.

* * *

GRASS-SEED PRODUCTION DEPARTMENTAL TRIALS and farmers' experience have shown the benefit in increased yields to be obtained by topdressing ryegrass-seed and cocksfoot-seed crops with nitrogenous fertilisers. On land deficient in nitrogen the weight of seed harvested has been doubled. Applications are best made in spring when paddocks are closed for seed production, though older stands also benefit considerably from autumn topdressings. In general, applications of 1cwt. per acre of sulphate of ammonia are recommended, though heavier rates can be used successfully. Cocksfoot and perennial ryegrass have given good responses from 2cwt. of the fertiliser per acre, but similar amounts on short-rotation and Italian ryegrasses, growth of which is more prolific, tend to cause excessive lodging, lighter applications generally being more satisfactory. However, heavy applications of nitrogenous fertilisers may have a deleterious effect on the clover content of swards, and on pastures intended for subsequent grazing excessive use of nitrogenous fertilisers should be avoided.

Honey House Equipment

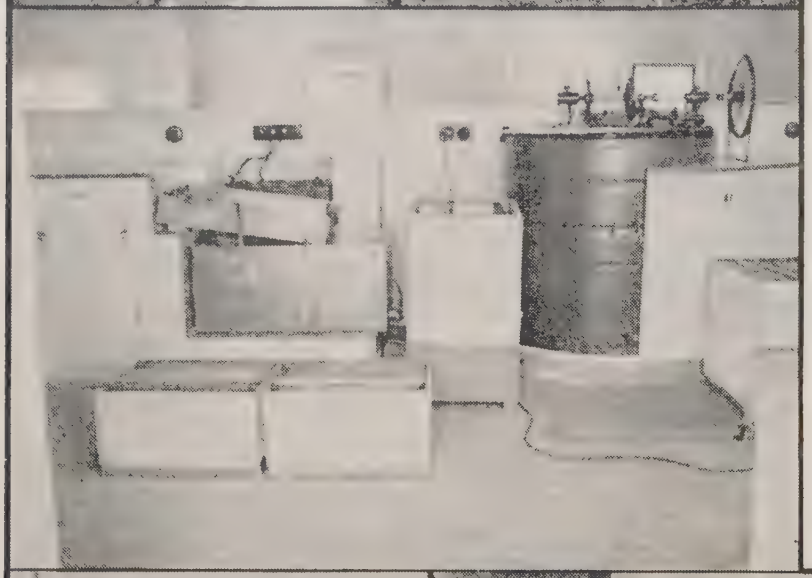
By C. R. PATERSON, Apiary Instructor, Department of Agriculture, Hamilton

THE individuality of beekeepers is very evident when a survey is made of honey houses, even in the same district. Generally honey requires much the same handling, irrespective of in what part of New Zealand apiaries are situated. The only exceptions are areas where manuka predominates. Once the bees have stored the honey in the hives and capped it over, thus giving it the seal of maturity, beekeepers take charge and they are responsible for seeing that honey reaching the consumer is of the same high quality as that received from the bees. This article describes a honey house constructed and equipped by Mr. J. D. Hishon, of Morrinsville, to handle the produce of about 300 hives.

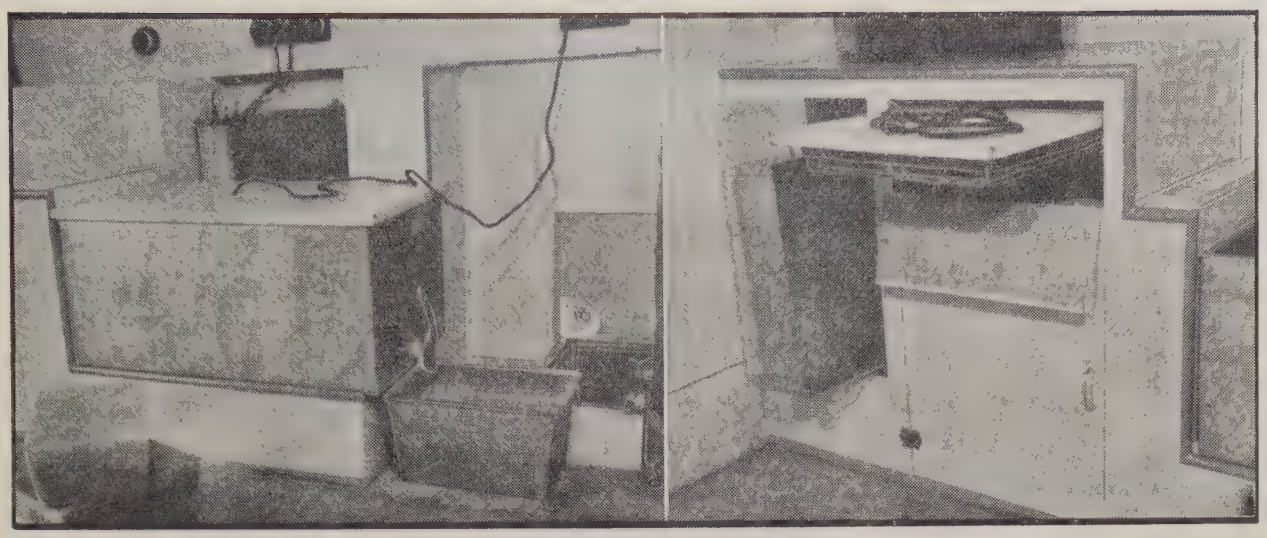
TO extract honey the beekeeper requires a bee-proof building to work in, some means of cutting off the wax cappings which seal the honey in the comb, a machine that will extract the honey so that the empty combs may be returned to the bees for future use, and a system of moving the extracted honey through a straining or clarifying unit into the storage tanks. All these processes are necessary, but each beekeeper appears to have his own system of working.

Honey House Construction

As the site chosen for Mr. Hishon's honey house was on the side of a hill, a two-level building was constructed. All floors are concrete with the walls



Upper—View showing L shape of honey house. Middle—Extracting room, showing combined cappings strainer and melter with hot tray on top, full combs (left), empty super to hold uncapped combs (centre), and extracted combs (right). Lower left—Unheated gravity-type honey strainer which takes honey from the extractor and the cappings unit. Lower right—Extracting and tank rooms; the tank lids are made of hardboard.



Left—Cappings being melted with top-heat unit. Marketable cakes of beeswax are shown at left. Right—Odd spaces are fitted with cupboards to hold equipment (such as the lid for the cappings box shown here) when not in use.

and roof of asbestos sheeting. The inside is lined with wallboard and painted cream. Doors A and B in the plan below were to be the main unloading doors to each level, but as a trailer has to be used at present, door C has been found more convenient. Gauze screens can be used on A and B to improve conditions during hot weather. A feature of the honey house is that it is never used for any purpose other than the extracting and packing of honey. Equipment is placed conveniently in the centre of the building, leaving the maximum of available floor space for supers and packed honey.

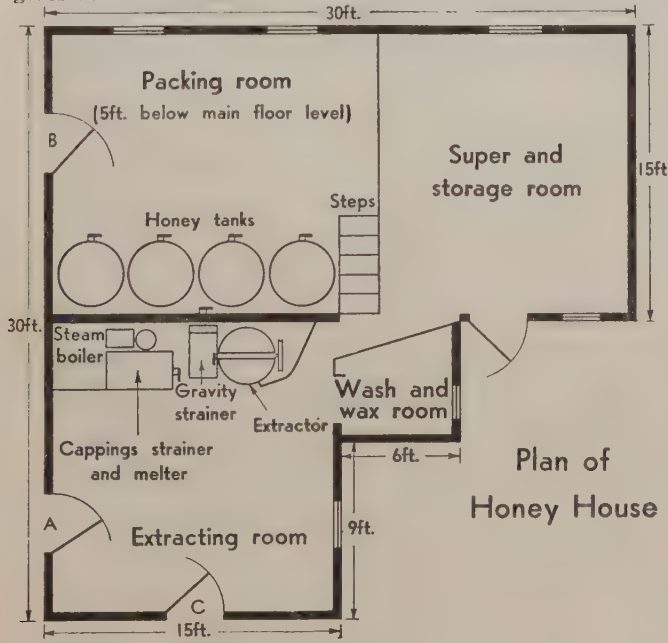
Extractor

The extractor is of the 6-frame reversible-basket type. It is driven by a ½ h.p. electric motor which is housed beneath the counter. A small door gives access so that the motor may be adjusted. The extractor is raised about 6in. on a neat concrete stand which fits in with the curve of the covering cupboards. Anchor rods hold it firmly in position but allow it to be taken down easily for cleaning and for checking the bearings at the end of each season.

Uncapping System

An electric boiler with water reservoir supplies steam to the uncapping knife and a hot tray. This tray warms the honey in the cappings before they drop into the wire basket below, thus allowing the honey to run away quickly.

The lower container is made of tinned copper and has a water jacket. An electric element and thermostat keep the water at a temperature of approximately 130 degrees F. This heat also assists in freeing the honey from the cappings and allows it to run into the strainer compartment below the extractor. The wire basket in this container will hold the cappings from approximately 18cwt. of honey. When extracting is finished the hot tray is replaced by the lid which can be seen in the upper right illustration. This lid fits neatly over the cappings box. The cappings can remain in this condition until the morning, when most of the honey will have drained out. The top heating unit in the lid is then switched on and in a little more than an hour the wax can be run out into the moulding can shown in the upper left illustration.



Plan of Honey House

Straining System

As the honey tanks are on a lower level than the extracting room, a simple type of gravity strainer can be used. This strainer is approximately 18in. x 9in. x 12in. deep with a baffle plate at the far end which allows the semi-clarified honey to come up from the bottom before it runs out into the tanks. The honey gate at the bottom is used to drain the strainer at the end of the day. This can be seen just above the tanks in the lower right illustration on the opposite page. Mr. Hishon finds this strainer collects much of the coarser particles of wax, and a heavy skimming is required after the honey has settled for several days in the tanks. The efficiency of this type of strainer is dependent on a fairly slow and steady stream of honey coming in all the time; otherwise the wax particles do not have time to rise to the surface, but are carried along in the movement of honey. Warmed honey or a heated straining unit would, of course, allow much more honey to be put through in the day.

The honey from the strainer is carried to the tanks by an open chute which swivels round to fill any of the 4 tanks. To prevent the honey from dropping directly into the tank the end of the chute is constructed so that whatever tank is being filled the honey runs down the inside of the tank, thus preventing undue aeration of the honey.

A feature of this honey house is the manner in which all odd spaces are made into cupboards, which are useful for storing extracting equipment when it is not in use.

The wash room, which is also used for the storage of beeswax, has water laid on.

High Standard

The general layout and neatness of this honey house indicate that this beekeeper is maintaining the very high standard required when handling a food.

COCCIDIOSIS IN

MASS-PRODUCTION and intensive methods of keeping poultry have led to an increase in the incidence of coccidiosis in flocks. In this article by J. J. Thompson, Veterinarian (Poultry), Department of Agriculture, Wellington, particular attention is given to the chronic type of intestinal coccidiosis and to the measures required to keep pullet flocks free from this debilitating disease.

COCCIDIOSIS is the most common disease of poultry throughout the world, and few poultry producers have escaped the losses which it usually causes. The widespread nature of the disease has encouraged intensive investigation, and as a result it is not now the tremendous obstacle to rearing poultry which it formerly was.

Description of Parasite

To combat this lethal disease it was first necessary to study the parasite which causes it, to understand its method of propagation and the conditions which encouraged multiplication and development, and to define its relationship to the host—the bird which it parasitises. It is now known that eight different species may infect poultry, at least two being extremely dangerous to the health of the birds. Most species of coccidia have been found to be host specific; that is, capable of infecting only one species of fowl. Coccidia which affect wild birds such as the sparrow do not infect domestic poultry.

The coccidia which occur in the droppings are minute, oval organisms visible only under a microscope. When they are passed out in the droppings from 1 to 4 days are required for development into the infective stage under favourable conditions. On being ingested by another bird a parasite divides and each part enters the cells of the lining of the intestine. These parts grow and divide and redivide many times, each new division entering the wall of the intestine. After undergoing such massive multiplication each parasite is passed out in the droppings enclosed in a thick protective coat. Thus only a few coccidia need enter the host to multiply into many thousands and give rise to infestation.

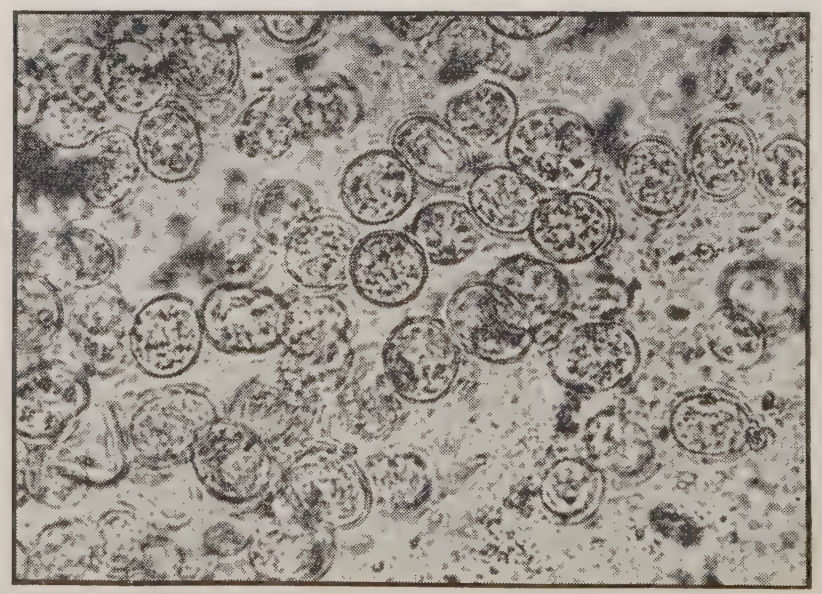
Factors Influencing the Disease

Because of the rapid increase in numbers of coccidial parasites in a bird's intestine it may appear that few birds could escape infection. In fact, no bird raised under the usual conditions does escape. Every fowl is subjected to invasion by the parasite, and this knowledge has led to increasing interest in what is known as the host-parasite relationship. This biological relationship has a natural balance which has been upset by man's intervention with mass-production and intensive methods. Under natural conditions a bird is subjected to small, repeated invasions by coccidia picked up sporadically; such doses are known to give rise to an eventual immunity from or resistance to the disease. Birds kept completely out of contact with their own droppings have no opportunity to gain immunity and, when subjected to normal range or laying-house conditions and contact with infected droppings, rapidly succumb to infection. Therefore extra care is necessary with chicks reared in a battery brooder, which frequently are badly affected unless they are later placed on clean range.

A young pullet showing symptoms of severe intestinal coccidiosis and unable to stand upright because of general debility.

However, the immunity gained from exposure to small doses of coccidia is not absolute, and it may be broken down if the birds are subjected to a massive invasion through being kept on grossly contaminated litter or if conditions favour survival of the parasites. Such conditions are created by overcrowding or damp litter. Coccidiosis may be regarded as the result of exposure of susceptible birds to coccidial oocysts.

Perhaps without the farmer's knowledge, this method of creating immunity to the disease by exposing birds gradually to infection is being carried out commonly. Building up immunity without inducing the disease is not easy, and the balance frequently breaks down under management conditions, leading to an outbreak of coccidiosis. The well-known and yet often-neglected precepts of adequate feeding, avoidance of overcrowding, chilling, or overheating, and particularly the maintenance of dry litter, play a major role in weighting this balance. Exponents of the built-up



A microphotograph of droppings from a coccidiosis-infected bird, showing numerous oocysts. The double outline of the shells is quite distinct. In this stage the parasites are not infectious.

POULTRY FLOCKS

Dosing birds with carbon tetrachloride from an automatic gun or in capsules eliminates round worms, which are often associated with coccidiosis.

litter system claim, with good reason, that a strong immunity to coccidiosis may be established under that system, but it will provide suitable conditions only if the properties of the litter are understood and the factors favourable to its proper function are maintained.

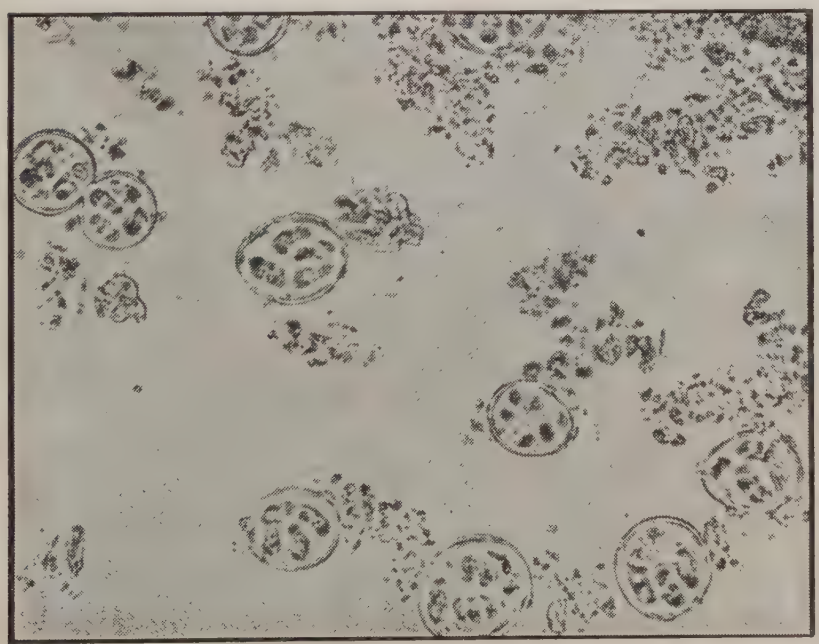
In brief, immunity from coccidiosis may be stimulated by slow exposure of birds to the parasite. This immunity may be broken down by poor conditions of management or feeding which permit a massive accumulation of coccidial oocysts in the litter.

Immunity to one species of coccidia does not imply resistance to another. Birds which have recovered from caecal coccidiosis may later be affected with intestinal coccidiosis.

Caecal Coccidiosis

Of the two types of infection, which affect different classes of stock, caecal coccidiosis is well known to poultry farmers because of the startling losses it may cause—up to 80 or 90 per cent. of a batch of chicks. This form of the disease is caused by a species known as *Eimeria tenella*, which infests the caecum, giving rise to extensive damage of the lining membrane and blood in the droppings.

The discovery of the curative properties of the sulphonamide drugs has greatly reduced the loss from this form of cocciodiosis, sulphamethazine and sulphaquinoxaline in particular being of specific value. However, the use of these drugs is not a substitute for good management, and for treatment to be effective it must be applied immediately the first symptoms are observed in a batch of chicks. If it is delayed for a few days, heavy loss may occur and the survivors will have developed an immunity to the disease which makes treatment superfluous.



The droppings 48 hours later, when the parasites had developed inside the shell into four spores each. When consumed by susceptible birds the spores are liberated in the bowels and start the infection.

Intestinal Coccidiosis

The second type of the disease which is causing concern to many poultry farmers in New Zealand is known as adult, duodenal, or more correctly intestinal coccidiosis. It is the result of heavy infestations of either *Eimeria necatrix* or *Eimeria acervulina* species of coccidia. *E. necatrix* may affect young pullets very severely, causing a disease which may be acute but is more usually chronic. *E. acervulina* is less dangerous, but it causes a chronic type of coccidiosis which affects growth and condition.

Symptoms

The acute form of the disease is not very common in flocks, but occasional outbreaks occur. The effects are very severe and heavy mortality may follow. Affected birds appear dejected and pale in the comb and may collapse rapidly. Frequently blood is passed in the droppings.

The chronic type is exceedingly common. The onset is slow and insidious, with only a small number of birds showing signs of infection. Paleness of comb and wattles, gradual loss of condition, poor appetite, and delayed development are typical signs. Later the comb becomes shrunken and the bird emaciated. The breastbone becomes prominent through loss of flesh and the feathers are bedraggled and unkempt.

Leg weakness in the birds may cause the owner to suspect fowl paralysis. Diarrhoea may be evident. Occasional deaths occur, but the mortality rate usually is not heavy. Egg production is delayed or lowered if the birds are laying.

Post-mortem Appearance

The affected portion of the bowel is highly inflamed and thickened by the acute form of the disease. The contents may be blood stained or even consist almost wholly of blood.

In the chronic form the mucous membrane or lining of the upper or middle portion of the bowel is thickened and has a furry appearance. Small white spots are often visible from the outside before the bowel is opened; these patches are caused by forming oocysts. Inflamed areas and a little blood may be evident on the inside lining membrane. Frequently the carcass is poor and emaciated.

Microscopic examination of a smear from the intestinal wall spread on a glass slide shows oocysts as rounded or oval bodies containing a central dark mass.

Treatment of Intestinal Form

The acute type of intestinal coccidiosis may be treated successfully with sulphamethazine if administration is begun immediately symptoms are shown by the birds.

However, no evidence shows that any drug will alter the course of established outbreaks of intestinal coccidiosis, and no specific drug or treatment is available for use against the chronic form. Extensive culling of affected stock and improvement of management and hygiene are the only possible measures of control.

Origin of Infection

As the coccidia are widespread, how is an outbreak of the disease to be avoided? Why does it occur on some farms and not on others, and on a farm in one year and not in the next? The answer again lies in the slow building up of immunity to the disease by gradual exposure of the birds to infection.

Infection is always present, so it is essential to ensure that the exposure to parasitic invasion is gradual and that the body defences are in good order and able to build up immunity. Therefore environment is of obvious importance in providing conditions which will lead to an efficient resistance to the disease.

Experience of many outbreaks of chronic intestinal coccidiosis has shown that a number of faults in management are primarily responsible. One or more of these faults may be the initial cause:—

Bad management on range during the growing period. Overcrowding and the use of poor range or ground which has not been allowed to remain empty for a period are dangerous.

Inadequate feeding, especially lack of animal protein such as meat meal.

Heavy infestation with round worms and neglect of deworming, which lower resistance to disease. In a great many birds worm infestation and chronic coccidiosis are both present.

Vitamin A deficiency. If the range is poor or the greenfeed inadequate in quantity or quality, deficiency of this important vitamin may predispose the birds to disease. Deficiency of vitamin A is often associated with outbreaks of chronic coccidiosis.

Insufficient litter in the laying house. Litter which is allowed to become damp and sticky with droppings, or wet in areas around water troughs, provides ideal conditions for survival of coccidia.

Insufficient culling through all stages of growth. Ailing or unfit birds remaining in the pen act as reservoirs of infection for healthy birds. Culls from healthy flocks are frequently found to be affected with chronic coccidiosis. Such birds are a danger to the flock.

Prevention and Control

Measures to safeguard the flock against this debilitating disease must start in the early stages, and they involve fundamental care in management. Avoiding the faults mentioned will ensure a healthier flock.

Dosing for worms when the birds are 3 and 5 months of age, using carbon tetrachloride liquid or capsules, should be routine. A careful check on the diet is necessary to ensure that adequate proteins and vitamin A are provided. Overcrowding on range or in the laying house and damp litter will almost certainly lead to an outbreak of coccidiosis. Constant culling of poor, unthrifty birds is not only an economic but a disease-control measure.

Where an outbreak has occurred culling must be immediate and ruthless and a careful check made on management and other environmental factors. If worm infestation is present, the pullets should be dewormed. Supplementing the diet with additional vitamin A in the form of fish oil is often effective.

However, if the disease has been allowed to run too long before control measures are instituted, attempting its eradication may not be economic. Destruction of the affected batch of birds may be the only advisable course.

Workers overseas have shown that poultry may be protected against both the caecal and intestinal forms of coccidiosis by supplying small amounts of sulphaquinoxaline, sulphamethazine, or certain other chemical agents in the drinking water or mash. These drugs are of value, particularly to the poultry producer who is dealing with large numbers, but their use increases costs of production. The drugs confer protection by suppressing the activity of coccidia at a certain stage while the bird is exposed to infection by the parasite and the body is gradually acquiring immunity. The immunity against adult coccidiosis takes some time to build up, and use of the drugs does not obviate the necessity for continued good management.

To avoid disheartening loss from chronic intestinal coccidiosis the poultry farmer must give careful forethought to avoidance of errors in early management which create conditions suitable for the parasite and militate against the health of the pullets and the resistance they will acquire to the parasite.

Further advice about prevention and control of coccidiosis or any other disease of poultry may be obtained from Poultry Instructors or Veterinarians or from the Veterinarian (Poultry), Department of Agriculture, Box 2298, Wellington.

World Census of Agriculture

Increase in Number of Holdings and Mechanisation in New Zealand

THE first World Census of Agriculture was held in 1930, but the second, which was to have been held in 1940, was abandoned because of the war. That taken last year enables comparisons to be drawn with 1930 for certain special items which are collected only on such occasions.

Holdings

One such item concerns occupancy of holdings. Of particular interest are the following figures for New Zealand:—

	Number of holdings	
	1930	1950
Occupied by Maoris .	2,715	4,334
Idle or unused ..	6,330	2,262
*Occupied by manager	1,222	2,524
*Occupied by share-worker	781	2,251
*Occupied by owner or lessee	83,164	†85,417

* These three groups comprise the total number of holdings.

† In 1950 the number of holdings occupied by owner, lessee, partly as owner and partly as lessee, and by partners were respectively 55,060, 17,819, 11,303, and 1,235.

Land held and worked under the Maori communal system is not covered by annual or world agricultural census returns. A notable feature of the 1950 returns is the increase in the number of holdings being worked by Maoris as individuals. The material reduction in the number of holdings idle or unused is significant of the demand for land. There is an increasing tendency for owners to employ managers or shareworkers to operate their holdings, but the total number not worked by the owner or lessee is relatively small.

Farm Horsepower

A fairly full range of farm implements, plant, and equipment was covered for the first time in the 1950 census, and the figures show that New Zealand farmers are employing power mechanisation to a high degree. Electric motors, internal-combustion engines, tractors, and rotary hoes represent collectively a little more than 1,000,000 horsepower, compared with about 150,000 h.p. 20 years earlier. Motor-trucks and cars represent about another 1,000,000 h.p. available to farmers today (in round figures 25,000 motor trucks and 48,000 cars). Between 1930 and 1950 draught and cart horses decreased in numbers from 180,000 to about 100,000.

Journal of The British Grassland Society

This Journal is a medium for the publication of the results of research and practical experience in the realm of Grassland Husbandry.

Contents of Vol. 5, No. 4, 1950.

1. Soil Fertility and Pasture Growth. P. D. Sears.
2. The Effect of Early Defoliation on Lucerne Seedlings. D. P. Bignoli.
3. Renovation of an Aged Seed Stand of S.143 Cocksfoot. T. A. Evans.
4. The Ecology of Medicago sativa L. in South America. A. Boerger.

This Journal is published quarterly. Subscription Vol. 1, 15s. Annual subscription thereafter, 30s. per volume. Orders to Secretary, British Grassland Society, Fakenham, Norfolk.

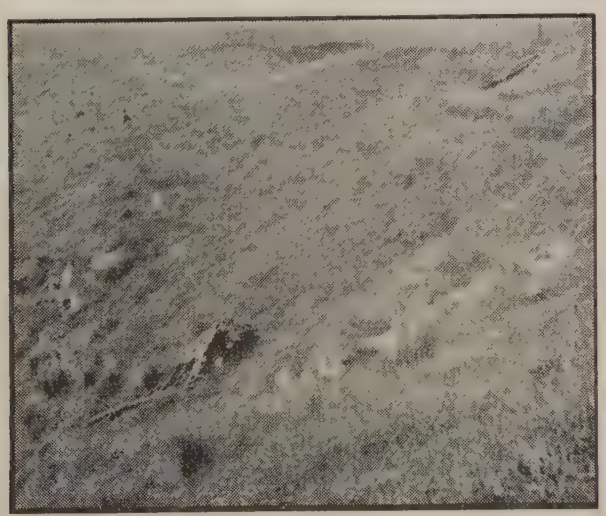
Improvement of Hill-country Pastures by Oversowing

IN an endeavour to find out which clovers and grasses are most suited for the improvement of hill-country pastures, and the time of the year to obtain the best strike and establishment, the authors of this article, F. E. T. Suckling, Technical Officer, and G. S. Harris, Agrostologist, both of the Grasslands Division, Department of Scientific and Industrial Research, conducted a series of trials in 1948. Areas totalling more than 100 acres were oversown with a complex seeds mixture between early spring and late autumn. Districts included were Wairarapa, Southern Hawkes Bay, Manawatu, Taumarunui, Mangaweka, inland Taranaki, and Kawhia. In most of these districts four trials were laid down encompassing a diversity of soil types and climatic conditions. Though the sowings were completed within one year, local variations of climate were sufficient to provide a variety of seasonal conditions. The strike and early establishment of the sown species were similar in most cases, March sowings being better than those made during late autumn and spring. Clovers struck and established best, while little success was obtained with the grasses except on bare or burnt areas.

OF the 12,000,000 acres of sown pasture in the North Island more than half has been surface sown after the felling and burning of forest. The initial seeds mixtures used on the forest burn included species such as rape, turnips, cocksfoot, ryegrass, timothy, dogstail, white clover, red clover, and alsike, which thrive best under high-fertility conditions. The ash from the burn provided initial high fertility, and these mixtures gave considerable success in establishment.

Decline in Fertility

However, it was not realised that this fertility was merely temporary, and pastures deteriorated rapidly after the initial high-production period. Sixty years ago, when most of this hill country was sown to grass, little emphasis had been placed on strain in pasture plants, with the result that much of the seed sown produced plants that were not particularly long lived or productive, and this no doubt contributed to the deterioration.



A hill-country pasture 2 years after it had been surface sown.

Hill country typical of that on which the surface-sowing trials referred to in this article were laid down.

LOCATION OF TRIAL AREAS

District	Locality	Soil type	Parent material
Wairarapa	Hinakura	Taihape silt loam	Mudstone
	Gladstone	Te Aute loam	Limestone
	Stronvar	Te Wharau fine sandy loam	Sandstone
	Matahiwi	Ngaio silt loam	Greywacke
Southern Hawkes Bay	Mangahei	Whangamomona silt loam	Sandy mudstone, sandstone
	Ti-Tree Point	Taihape silt loam	Mudstone
	Horoeka	Waikura sandy loam	Argillite
	Coonoor	Te Aute loam	Limestone
Mangaweka	Mangaweka	Taihape silt loam	Mudstone
Taranaki	Kohuratahi	Hangaroa sandy loam	Taupo ash, mudstone
	Tahora	Hangaroa sandy loam	Taupo ash, mudstone
	Tahora	Whangamomona silt loam	Sandy mudstone, sandstone
Taumarunui	Otangiwai	Mangatu clay loam	Mudstone, sandstone
	Kaitieke	Tapuwai sandy silt clay	Thin Taupo ash on sandstone and greywacke
	Kaitieke	Taumarunui sandy silt	Taupo ash on sandstone
Raglan	Te Mata	Kauroa silt loam	Mairoa ash over basalt, sandstone, and greywacke
Manawatu	Linton	Ruahine silt loam	Greywacke

As a result of this process over several decades most hill-country pastures are producing sufficient to carry only ½ to 1½ ewes per acre. Any treatment which can increase this carrying capacity economically will have a marked effect on production in view of the tremendous acreage involved, and in addition any pasture improvement that can be achieved will contribute to soil conservation by reducing run-off and consequent soil loss.

One noteworthy feature of hill-country pastures in all districts is the deficiency of perennial clovers in the sward. Pasture investigations by the Grasslands Division have demonstrated that little or no increase in pasture production results from the application of superphosphate to a clover-deficient sward (1). On the other hand, a balanced grass-clover pasture shows a marked response. This fact makes doubtful the value of phosphatic topdressing, by aircraft or other means, on random areas of hill country unless good perennial clover strains are present in amounts sufficient to make use of the fertiliser.

Experimental Method

To ensure that a variety of soil types and climatic conditions was included, trial areas were widely distributed within each district, as shown in the table on this page.

1. Sears, P. D.: "Phosphate and Clovers", "The New Zealand Journal of Agriculture", September, 1949.

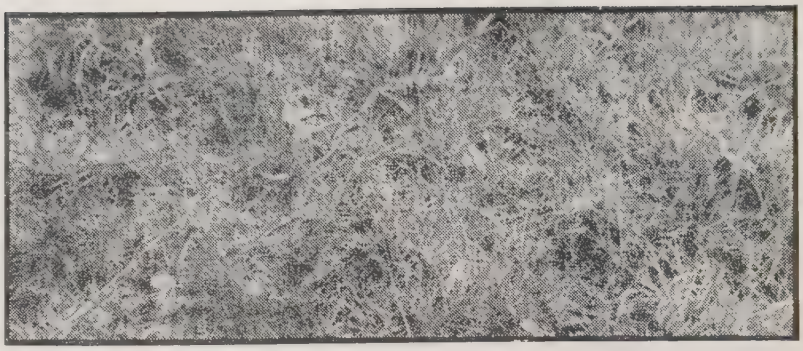
On each area sowings were made at six different times of year in an attempt to establish the most suitable month for oversowing with grass and clover seeds. The areas were all hand sown with the following complex seeds mixture: 10lb. of perennial ryegrass, 10lb. of short-rotation ryegrass, 3lb. of crested dogstail, 1lb. of cowgrass, 2lb. of Montgomery red clover, 2lb. of subterranean clover, 1lb. of white clover, 1lb. of strawberry clover, ½lb. of *Lotus major*, and ½lb. of *Lotus hispidus* per acre.

Sowings were made in March, April, May, August, September, and October. The strike of sown species in all cases was recorded by seedling counts on random quadrats within each acre block (2, 3).

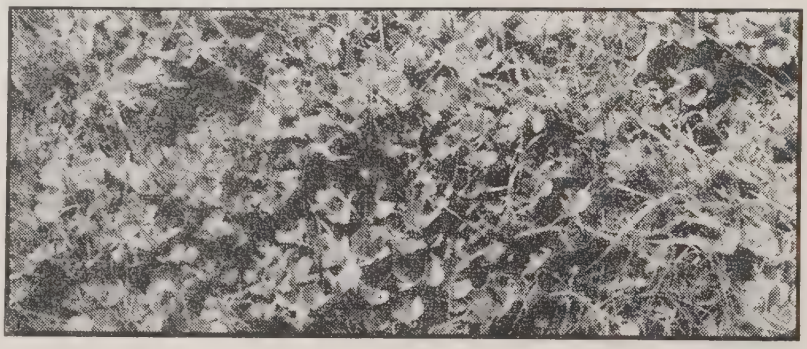
Results of Sowings

March sowings were the most successful in all trials. Later sowings generally gave poorer results, though some late-autumn and late-spring sowings produced fair results. Typical establishment counts made on these trials are given in the table on this page.

The most suitable conditions for oversowing are provided by the rather open pastures which follow a dry summer period. A notable feature was the poor strike obtained when there was a dense sward of such species as Yorkshire fog, sweet vernal, browntop, and danthonia.



Above—A clover-deficient sward of the type common on most hill country. Below—An improved sward resulting from oversowing.



Grass species showed a poor strike on all areas. The grass seed tended to lodge in the existing sward rather than penetrate to the soil as did the heavier clover seed. Germination occurred with the first rains and the seedlings were dried off by wind and sun. In general, grass species established only on open or bare spots.

Main factors responsible for failure to establish were late sowings, seedlings being destroyed by winter frosts, and losses caused by birds, slugs, and insects. The more closely grazed areas showed evidence that sheep caused damage by biting off the seedlings below the crowns.

Of the species sown red, white, and subterranean clovers were the most successful. Observations failed to account for the failure of strawberry clover and *Lotus major*, but ecological factors such as moisture supply were not generally favourable to these species.

Factors Affecting Establishment

The principal factor controlling establishment by oversowing appears to be time of sowing, and this is closely related to the moisture supply available to the developing seedling and to competition from species already established in the sward.

All the poorer strikes were associated with dry soil conditions, this being a reflection of the soil type. Even under high rainfall such soils lose moisture rapidly and false strikes are obtained.

The application of fertiliser at the time of sowing would appear essential for establishment, and if high-producing clovers are sown, further topdressing is essential if they are to produce even a fraction of their potential.

Though in certain instances results were not entirely satisfactory, the over-all response to surface sowing was encouraging. A relatively low proportion of the sown seed established, but a satisfactory cover of clover seedlings resulted in most cases.

2. Suckling, F. E. T.: "Proceedings of the Eleventh Conference of the New Zealand Grassland Association", 1949.

3. Madden, E. A., Harris, G. S., and McKee, J. G.: "Proceedings of the Eleventh Conference of the New Zealand Grassland Association", 1949.

EFFECT OF DATE OF SOWING ON STRIKE OF CLOVER AND GRASS SEEDS

Locality	Month of Sowing	Seedling establishment as percentage of viable seeds sown						
		Red clover	White clover	Lotus species	Strawberry clover	Subterranean clover	Ryegrass	Crested dogstail
Mangahei ..	March ..	42	32	4	14	58	6	16
	April ..	22	27	2	0	0	2	7
	May ..	3	11	4	trace	0	trace	0
	August ..	2	19	0	3	0	trace	0
	September	10	8	0	0	0	0	0
	October ..	11	4	1	0	2	0	0
Coonoor ..	March ..	46	29	6	0	94	10	1
	April ..	45	35	3	17	1	0	0
	May ..	8	10	trace	14	1	0	0
	August ..	11	6	trace	1	18	trace	0
	September	19	14	3	0	16	0	0
	October ..	24	11	1	0	13	1	0
Ti - Tree Point	March ..	24	22	0	16	98	8	1
	April ..	45	19	2	0	87	4	3
	May ..	1	1	trace	0	2	2	0
	August ..	7	7	2	0	0	trace	0
	September	3	2	0	0	13	trace	0
	October ..	1	trace	0	0	7	trace	trace
Mangaweka ..	March ..	14	45	65	17	98	49	11
	April ..	7	26	32	0	51	28	6
	May ..	1	trace	1	1	7	trace	0
	August ..	9	21	10	2	4	2	0
	September	10	14	trace	2	14	1	trace
	October ..	31	42	9	3	12	1	trace
Horoeka ..	March ..	24	5	1	0	65	5	1
	April ..	6	3	0	0	0	2	0
	May ..	2	3	0	0	1	0	0
	August ..	2	4	2	0	0	trace	0
	September	2	0	0	0	5	0	0
	October ..	trace	trace	0	0	0	0	0

Efficient Application of Sprays

By I. L. BROWN, Orchard Instructor, Department of Agriculture, Nelson

THE successful production of fruit and vegetable crops is largely dependent on efficient control of insect pests and diseases by applications of suitable sprays. These sprays must be applied correctly and thoroughly if the time, labour, and expenditure involved are not to be partly or completely wasted. Neglect or disregard of any of the many factors relating to their application can be the cause of loss of all or part of a crop or even damage to the tree or plant itself.

UNSUCCESSFUL plant-protection measures are often attributed to faulty materials, and though this is not an impossibility, incorrect use or poor application of the sprays more often contributes to complete or partial failures.

The success or otherwise of plant protection by spraying depends on observation of the following factors which govern application of sprays.—

1. Weather conditions.
2. Efficient equipment.
3. Timing of applications.
4. Rate of development of crop.
5. Use of correct and effective material.
6. Rates of application.
7. Methods of application.
8. Orchard and garden hygiene.

Weather Conditions

Adverse weather at any period of the year during which spraying operations are being carried out is often the cause of incomplete control being obtained. Long periods of wet weather after a spray has been applied can impair its efficiency as well as being conducive to the development of fungous diseases, while dry, warm conditions may favour insect pests. Sprays applied in high or gusty winds may also be made partially ineffective, as some of the spray is certain to be carried away, leaving parts of the trees or crops totally or partially unprotected. Sprays are essentially protective and unsprayed portions of trees or plants are thus left open to become centres of infection from which diseases and pests can easily spread. It is therefore better to spray before rain or other adverse weather than after, but since the weather cannot be anticipated with certainty, a regular programme must be adhered to, making alterations only to meet emergencies as circumstances determine. Weather conditions rarely permit intervals between sprays to be lengthened; rather do they necessitate shortening. Thus if heavy rain falls shortly after a spray has been applied, the interval to the next spray should be shortened.

Upper—Bad spray coverage; large drops of compounds remain after evaporation of water. Such an effect is usually produced by applying such a quantity of spray that the drops coalesce into larger drops. Lower—Good spray coverage; an unbroken film of compounds remains after evaporation of water.

Efficient Equipment

Faulty equipment is another common contributor to poor disease control. Spray outfits which do not maintain good and constant pressure at the nozzle are difficult to operate and prevent a good, fine mist of spray being applied to the plant. A good mist of minute spray droplets is necessary if a good coverage of the trees or plants is to be obtained. Too coarse a spray will give incomplete protection and may also cause damage where the large drops concentrate.

[*News-photo Service photo.*

Good mist of fine spray droplets.

It is essential that spray vats are fitted with efficient agitators to keep spray mixtures well stirred. Lack of agitation can cause errors in rates of application, as a great number of spray materials do not dissolve in water, but merely remain in suspension, and without agitation they will gradually settle to the bottom of tank or vat.

Spray equipment in bad repair and constantly breaking down also has obvious adverse results on a spray programme. Machinery should be checked and repaired if necessary before it is required and in between spray applications. It is always advisable to have on hand a supply of spare parts to replace those that wear quickly or can be expected to give trouble. Quick repairs to unexpected breakdowns during spraying operations may be the means of preventing serious loss.

The efficiency of spray equipment and material also can be impaired by lack of cleanliness. All spray residues should be removed from equipment after use, and when the kind of spray is being changed all pump parts and measuring utensils should be thoroughly washed or cleaned. If this is not done, chemical reactions between materials which reduce the effectiveness of the spray and even harm the plant or fruit may occur.

Timing of Applications

Timing of applications is most important, as much damage can be done by diseases or insect pests before a spray is applied. Periods of application should be timed to give the optimum of protection to the crop. Fungicides and insecticides, either singly or in a combination, must be applied to plants before infection occurs. Spray programmes which have proved partially or completely ineffective should be examined to determine if applications were made in time to prevent entry of the pathogen or pest to the crop or if the subsequent applications were frequent enough to maintain the necessary protection during the period the crop or plants were open to attack.

Rate of Development of Crop

Timing of applications may also be governed by the rate of the development of a crop. Plant surfaces are constantly changing and increasing, thus producing new surfaces which will remain unprotected until the next spray is applied. Therefore where crops are developing rapidly the intervals between applications must be short.

The use of incorrect or faulty materials is not often the cause of poor control being obtained. Nevertheless care must be exercised in selecting materials, particularly as many of the new chemicals now available have specific uses only and are not suitable for general applications. Many are toxic to man as well as to disease or pests and must be used with discretion.

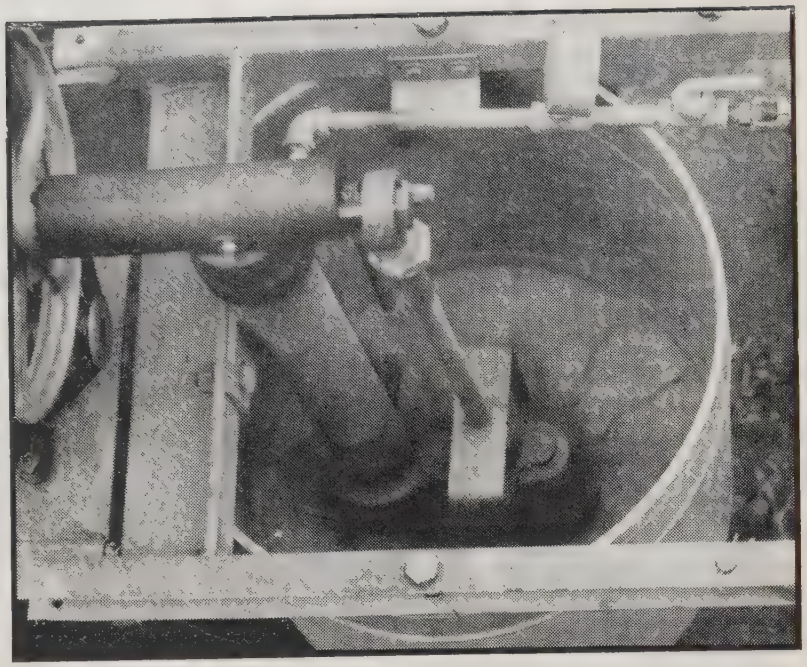
Indiscriminate and thoughtless applications of any spray material may bring it into disrepute, even if it has most desirable properties.

Spray ingredients as received from the manufacturer are usually of a guaranteed standard, but failure due to the use of faulty chemicals can occur. Many chemicals deteriorate with storage, and growers who carry over material from one season to another or who hold stores of any chemical likely to deteriorate should ensure that they are still effective before use. As an example the insecticide hexaethyl tetraphosphate (H.E.T.P.) can be quoted. This chemical is very unstable and breaks down rapidly in the presence of moisture. Such a material must be treated carefully, stored in dry containers and applied immediately after it is introduced to spray mixtures.

Certain spray materials give more effective control of some diseases or pests than others, and judicious selection assures successful plant protection without harm to fruit or plant. For example, powdery mildews are readily controlled by sulphur materials while downy mildew is best treated with a copper spray such as Bordeaux mixture. Similarly, among the insecticides, a stomach poison such as lead arsenate is of little use for controlling sap-feeding insects though very effective against chewing insects.

Rates of Application

Even the correct kind of material must be used correctly or complete or partial failure may occur. Mixtures which are too weak or too strong can contribute to ineffective or uneconomical control measures. The former will be ineffective and the latter may cause damage to foliage or fruit. Strong applications are not a corrective for infrequent applications. Care must be taken to see that all the ingredients of a spray mixture are weighed or measured accurately and mixed correctly.



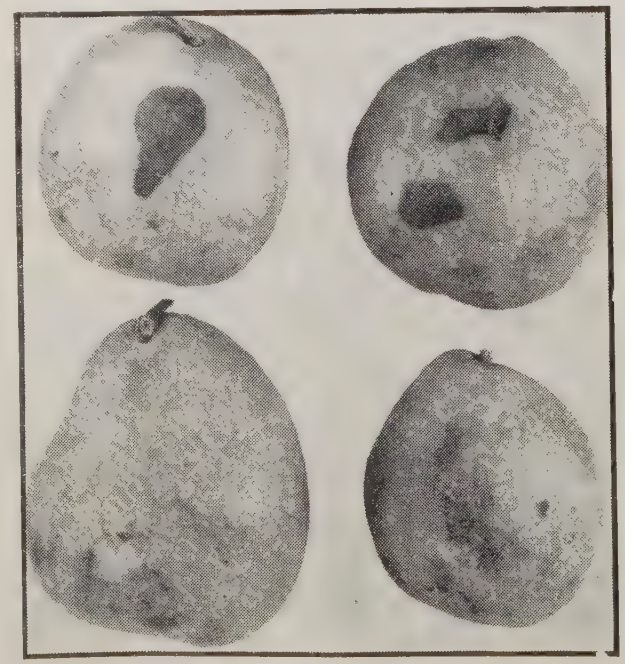
[*Jack Welsh and Sons photo.*

Good, clean spray vat (glasshouse equipment).

Methods of Application

Control measures correct in nearly every detail may prove ineffective if they are applied incorrectly. Lack of sufficient labour or the employment of unskilled labour during spraying operations may contribute to lack of success. Such a difficulty cannot always be overcome, especially at times when labour is hard to procure. Nevertheless attention must be paid to the manner in which sprays are applied to the trees or plants, as a complete coverage of all parts is essential.

Poor coverage of fruit or plant may also result from lack of adhesive properties in the spray mixture. Some plants such as garden peas, cabbage, onions, and some fruits are difficult to wet thoroughly. Sprays applied to such plants merely run off, leaving little or none of the desired protective residue. Where such a crop is being sprayed a wetting or spreading agent should be added to the mixture.



Spray damage on pears.

Hygiene

Finally, the most efficient spray programmes can be greatly impaired if garden or orchard hygiene is neglected. Disease- and pest-infested material should not be left in positions where it can become a centre from which infections can spread. All such material should be removed and destroyed or, if this is not possible, appropriately treated. Many commercial and domestic orchards or gardens can well receive attention to this phase of disease and pest control, particularly around hedgerows and headlands. Eradication of sources of infestation obviates recurrence or contributes greatly to the success of other protective measures.

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Grass-grub and Grass Caterpillar Control

IT has been found that there is a tendency to confuse the damage done by grass-grubs and that done by the subterranean grass caterpillar. As the types of injury to pasture are quite distinct and methods of control often different, it is important that farmers should understand clearly the differences between these two major pasture pests. This is the second part of an article on control of grass-grubs and the subterranean grass caterpillar by J. M. Kelsey, Entomological Research Station, Department of Scientific and Industrial Research, the first portion of which appeared in last month's "Journal". This concluding portion of the article deals mainly with the subterranean grass caterpillar, but it includes information which will enable farmers to distinguish between grass-grubs and the subterranean grass caterpillar and to realise why methods of controlling the pests differ in certain respects.

THE adult of the grass caterpillar is a moth which cannot feed, whereas the grass-grub adult is a beetle that is a very active feeder and often causes severe damage to crops, trees, etc. The grass caterpillar lives in an underground tunnel, but feeds only on parts of plants above ground level, whereas grass-grubs feed only on roots, etc., below ground level.

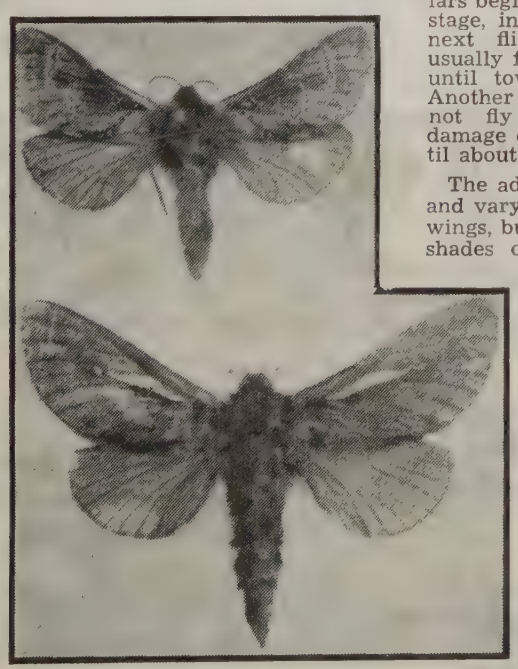
GRASS CATERPILLAR

The subterranean grass caterpillar is also known as the porina caterpillar and *Oxycanus* caterpillar; *Oxycanus* is its scientific name.

Species and Economic Status

There are at least two species causing major pasture losses, though one (*Oxycanus cervinata*) is reported by Dumbleton and Dick (8) to be the species responsible for most damage.

Oxycanus is present in both islands, but though it causes severe damage to occasional farms, playing areas, and home lawns in the North Island, the damage caused to farms in Canterbury, Otago, Marlborough, and Nelson results in thousands of pounds loss per year to farmers. In Mid- and South Canterbury in particular it has been found that all the small-seed (clovers and ryegrass) areas are subject to either partial or severe loss every year. On general grazing land the area treated against *Oxycanus* in 1950 was over 4000 acres, and this would have been much greater if supplies of insecticide had been available at the right time. Lucerne stands are also subject to damage.



Oxycanus (porina) moths; male (upper) and female (lower).

Life Cycle and Habits

A few moths of the species that is destructive in low-rainfall districts begin to appear late in September, but most fly in October to lay eggs. The latter hatch in from 3 to 5 weeks and the larvae or caterpillars are present until the following September and October. From July onward caterpillars begin to enter the resting or pupal stage, in which they remain until the next flight season. Pupae are not usually found in considerable numbers until toward the end of September. Another species (*O. despectus*) does not fly until January and larval damage does not become apparent until about August.

The adult insects are about 1in. long and vary fairly widely in markings on wings, but the predominant colours are shades of brown, black, and tawny. The moths are strongly attracted to lights when they emerge from the ground after dusk in October. They are rather sluggish at first, but soon may be seen fluttering about in short flights in pasture. It has been recorded (9) that flights appear to follow days of high temperature irrespective of the temperature on the nights of flight. The insects are unable to feed, as mouth parts are undeveloped, and they live for only 1 to 7 days. Females are usually mated almost immediately on emerging from the ground, and in less than an hour they begin to lay eggs.

Oxycanus (porina). Three stages of caterpillar development.

These are laid either while moths are on the ground surface or while they are clinging to vegetation. It is not usual for eggs to be laid while moths are on the wing, but this sometimes occurs under abnormal conditions such as when they bump into obstructions like stones, walls, windows, etc. The main factor governing choice of paddock appears to be the condition of the pastures. If they are reasonably good, most eggs are laid in the area where emergence occurs, but longer pasture (3 to 4in.) seems to be preferred to pasture which has been grazed very close.

Eggs are small, oval, and creamy white when laid, but within a few hours most of them turn jet black. They take from 3 to 5 weeks to hatch according to the relative humidity at ground surface. Humidities in the range 80 to 100 per cent. permit a higher percentage to hatch and also reduce the incubation period (10).

Caterpillars when very young are difficult to find on farms, but they are reported (10) to spend the first 4 to 6 weeks either sheltering beneath dense vegetation or within the top $\frac{1}{4}$in. of soil. From January onward they construct almost vertical tunnels in the soil to a depth of 6 to 10in. They shelter in these during the day and come to the surface at night to feed on the parts of pasture above ground level; they do not eat roots except possibly when constructing tunnels. The tops of tunnels in the early stages when pasture is dense are protected by a narrow tube-like tunnel above ground. This is made of fine soil particles held together with a light webbing, and is extended as food is eaten at the entrance. In time the webbing occasionally becomes almost a complete circle in severely damaged areas.

Fully grown caterpillars sometimes reach $2\frac{3}{4}$in. in length; they are rather limp and flabby when removed from the ground and do not curl up into the tightly coiled "watch spring" as do most of the other ground caterpillars such as army worms and cutworms. Caterpillars pass through periods in which they moult or shed their skins and in these stages they do not feed for about 2 weeks. Grasses are usually

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General view of pasture damaged by *Oxycanus*. Inset—Close-up view, showing crumbly nature of caterpillar casts. The smooth casts are those of worms.

destroyed completely, but the runners of clovers are normally left, except with very high population densities; this results in almost complete elimination of grasses and red clover, and leaves only white clover.

Population Densities

Population densities of caterpillars vary from year to year, but it is apparent when comparing numbers today with those recorded by previous workers for Canterbury that this pest is increasing in numbers. From 1939 to 1942 it was considered that a population of 15 caterpillars per square foot was exceptionally high; work from 1947 to 1950 has shown that the average for infested areas in Ashburton County is near 12 per square foot, and it is not uncommon to find them as high as 20, 30, and 45 per square foot. The average for a total area of 130 acres distributed throughout Ashburton County in 1949 was 13.4 per square foot, and in this acreage the lowest and highest averages were 6.3 and 23 respectively. In 1950 sampling showed that populations were in general equal to those in 1949, but there were more individual samples of over 20 per square foot.

Caterpillars are approaching the fully fed state from July onward, but it is not usual for appreciable numbers to enter the resting or pupal stage until August, and most reach that stage toward the end of September. Pupae are whitish at first, but soon turn a dark, reddish brown. They cannot feed, but are able to move up or down tunnels in the ground. When it is time for moths to emerge pupae move to the tops of tunnels and protrude for about half their lengths. The moths emerge when pupal cases split longitudinally down the back, and the life cycle is repeated.

Control

Farmers sometimes go to a great deal of trouble in attempts to control porina caterpillars, using methods that are not likely to give good results. Common practices are to use a heavy roller at night when caterpillars come up to feed, or to concentrate stock on damaged areas in the hope that stock when moving about at night will crush caterpillars. Tests show that these methods are a waste of time, because caterpillars are particularly sensitive to ground vibrations and will disappear down tunnels even when a person is walking slowly over paddocks.

Reports that irrigation will drown caterpillars are not borne out by observations or sampling. It is true that caterpillars are drowned where water lies in depressions for 12 hours or more or during periods of waterlogging of soil. Observations made while irrigation was being carried out showed that though *Oxycanus* caterpillars may be seen at tops of tunnels as waters pass over them, they are protected by air bubbles and retreat as soon as waters recede. The seagulls that commonly follow irrigation waters down borders feed on cutworm and army worm caterpillars, ground beetles and other surface-inhabiting insects, spiders, etc. Prolonged periods of flooding in late August and September would bring pupae to the surface, and once out of tunnels they seldom find their way back and would be picked up by birds.

Light traps and fires during October attract and destroy thousands of flying moths, but observations tend to show that before moths are attracted to lights sufficient eggs are laid to cause major damage the next year.

During ploughing, grubbing, and harrowing large numbers of caterpillars and pupae are destroyed or eaten by sea birds, starlings, etc., and by repeated cultivation it is possible to eliminate practically all of the pests, but if fallowing and cultivation are not carried out efficiently, damage to subsequent crops is likely to occur.

Chemical Control

The standard treatment against *Oxycanus* caterpillars is 2lb. of paris green in 25 to 30lb. of bran per acre and moistened with about 2 gallons of water to make the arsenate adhere to the bran particles. This bait gives excellent results where caterpillar populations average not more than 6 per square foot, but where populations are higher the percentage control decreases. In three paddocks treated in 1949 where populations averaged 7, 10, and 20 per square foot the control percentages based on pasture cover were 65, 60, and 20 respectively, and in one area in 1948 where the average population was 30 no control was achieved with the standard bait. In the 1949 tests 70lb. of bran and 3lb. of paris green were used in one test, but even this permitted only 40 per cent. pasture recovery on an area with an average population of 20 caterpillars per square foot.

The Entomological Research Station has shown that effective control of *Oxycanus* caterpillars can be achieved by the use of B.H.C. (benzene hexachloride) in superphosphate. Tests in Mid- and South Canterbury showed that B.H.C. applied at rates of 3¼ and 6½lb. of 13 per cent. gamma isomer in 1cwt. of superphosphate per acre gave 55 and 80 per cent. better control respectively than did 2lb. of paris green in 50lb. of bran. Recently a commercial product has come on the market for *Oxycanus* control; it is B.H.C. at a 10 per cent. gamma strength and is used at rates of 5 and 10lb. an acre to give control similar to the 13 per cent. applications. Also a fertiliser works in Dunedin is manufacturing a product consisting of 5lb. of B.H.C. at 10 per cent. gamma strength in each 1cwt. of superphosphate. This manufactured product saves farmers the trouble of handmixing the materials, but farmers may buy their own materials from most Canterbury stock and station agents or firms handling fertilisers.

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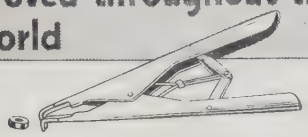

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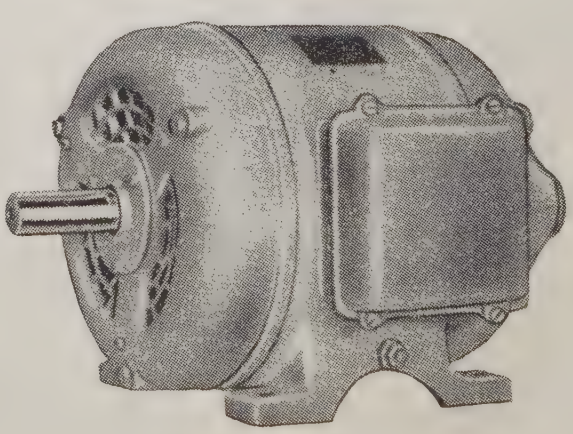

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The lower dosage of B.H.C. (3½lb. of 13 per cent. or 5lb. of 10 per cent.) is recommended for the treatment of general grazing land, but for small-seed production areas or where maximum control is required it would be advisable to use the double strength mixture (6½lb. of 13 per cent. or 10lb. of 10 per cent.). Those who wish to use the double strength could apply 2cwt. an acre of the factory-mixed material (in which case 2cwt. of superphosphate per acre is applied); buy the commercial product mentioned earlier and add 5lb. of it to each 1cwt. of factory-mixed material; or add 10lb. of the commercial product to each 1cwt. of superphosphate.

Soil profile showing *Oxycanus* caterpillar at bottom of tunnel.

The best method of mixing materials on the farm is to use a concrete mixer. It takes at least 3 minutes when the mixer is revolving at 25 revolutions per minute to secure an even mix of insecticide and superphosphate. If the bowl revolves too quickly, the materials do not tumble properly and the mixture is patchy and will give disappointing results. The bagged mixture will keep for 2 years, but it is advisable to roll bags occasionally, as, in common with straight superphosphate, the mixture tends to cake if left undisturbed. The insecticides if kept in tins with closely fitting lids should keep for several years without deteriorating.

If farmers do not wish to use superphosphate or it has already been applied, excellent control can be achieved by substituting B.H.C. for paris green in the bait (1lb. of 13 per cent. B.H.C. or 2lb. of the 10 per cent. commercial product to 50lb. of bran per acre; the 2 gallons of water should still be used to make the B.H.C. adhere to bran particles). This substitute gave 55 per cent. better control than the standard paris green-bran bait.

The baits have two disadvantages: They do not pass readily through most topdressers except those of the rotary and screw-feed types, and it is necessary to go over the same ground twice if superphosphate is to be applied. To compare the treated superphosphate and standard bait treatments on equal terms it is necessary to add the cost of superphosphate and a contract charge for bait spreading to the latter treatment.

The use of B.H.C.-superphosphate has several advantages over the paris green-bran bait.

1. B.H.C. is less toxic to stock and people handling it than is paris green.

2. It can be applied by drills or other standard farm implements handling superphosphate or lime.

3. More effective control.

4. Rain does not affect it adversely.

5. B.H.C. is both a stomach and contact poison.

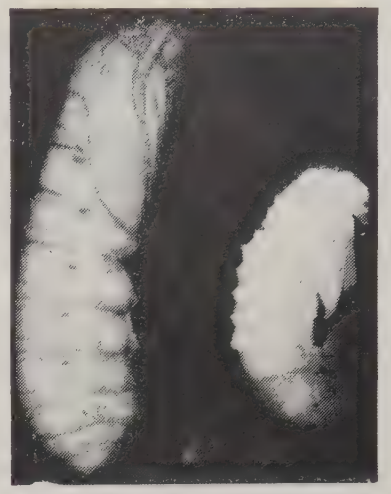
6. The superphosphate stimulates pasture growth.

7. Insect control and topdressing are carried out in one operation, with consequent saving in time and labour.

8. B.H.C. is effective against caterpillar populations as high as 20 per square foot.

The only disadvantage is that B.H.C. has an unpleasant smell. Over 4000 acres of *Oxycanus*-damaged pasture were treated throughout New Zealand with B.H.C.-superphosphate in 1950, despite the fact that the insecticide was not available until well into June.

Some farmers were unable to secure B.H.C. until the cold weather stopped pasture growth, and the effects of treatment in these cases will not be apparent in Canterbury until September. There have been several cases also where farmers were disappointed at finding live caterpillars as long as 6 weeks after B.H.C.-superphosphate had been applied; most of these farmers, however, were satisfied that pastures were recovering. Presence of live caterpillars need not worry farmers unduly; it is true that some *Oxycanus* will escape the effects of treatment even with the double dosage, and more will do so with the single strength, but B.H.C.-superphosphate treatment will give at least 55 per cent. better control than standard paris green-bran bait to which superphosphate has been added. The recommendations made are based on 4 successive years' work on the new insecticides, which were consistently superior to the standard paris green-bran bait. However, effectiveness depends entirely on uniformity in the mixing of the insecticide with the superphosphate, and if farmers do their own mixing, this point should receive adequate attention.



Oxycanus pupa (left) compared with grass-grub pupa (right).

Increased control would probably be brought about if a length of heavy-gauge diamond or chain mesh netting could be attached between tractor and topdresser. This would have the effect of removing the protective covering over tunnels, and insecticides would fall directly on ground that caterpillars would have to move over when feeding. This practice has not been used on a farm scale, but raking of lawns immediately before treatment results in better control than when lawns are not raked. Chain harrows would be excellent, but two operations would be involved.

Experiments showed that some caterpillars were still dying 7 weeks after application of insecticides. This is due partly to the fact that some caterpillars at any time will be undergoing one or other of the periodic moults, when they remain at the bottoms of tunnels and do not come to the surface for sometimes 2 weeks. In other cases there are small areas which do not receive a dressing of the insecticide-superphosphate (topdressers and drills rarely give perfectly uniform coverage). In one case investigated there was incomplete overlapping when the operator was applying the mixture; in other cases there are often wide, triangular areas left untreated where tractors make turns at fencelines.

When B.H.C.-superphosphate is applied the result for the first few days is that many caterpillars are seen writhing on the surface and they usually turn black within a few hours and die during the day. Rapid death is not due to the B.H.C. alone; the insecticide will affect some caterpillars within 15 minutes and prevent them going down tunnels, but they will often remain alive but partially paralysed for 2 to 8 days before dying. The blackening and rapid death are due to the effects of sunlight, to which *Oxycanus* caterpillars are remarkably sensitive.

Lawns: On tennis, croquet, bowling, and home lawns and on golf greens, where superphosphate or lime should not be applied because they encourage clover growth, the use of D.D.T. will give excellent control of *Oxycanus* at a reasonable cost. D.D.T. is used at a rate of 3 to 3½lb. of 100 per cent. (or its equivalent) wettable D.D.T. per acre in dry sand or soil or in the normal lawn fertiliser dressing. This works out at 1½lb. of 50 per cent. D.D.T. in 61lb. of fertiliser mixture or 61lb. of dry sand or soil for each 1000 sq. yds. of turf. The mixtures are applied at the rate of 1oz. per square yard of lawn. The dressing should be applied when turf is close clipped and preferably immediately after raking with a leaf rake to open up caterpillar tunnels on the surface.

The same treatment will also control grass-grubs and will remain effective against the latter and *Oxycanus* over two seasons. B.H.C. also could be used for lawns, and it is recommended that the double strength be used (10lb. of 10 per cent. per acre or 2lb. for each 1000 sq. yds. of lawn). B.H.C., though four times as effective as D.D.T. the first year, will not give the same degree of control of either grass-grub or *Oxycanus* in the second year after application.

Availability of B.H.C.: There are indications that adequate supplies of B.H.C. will not be available for the 1951 *Oxycanus* season, and though this is unfortunate, it is not of major importance, since the same degree of control of *Oxycanus* can be obtained by using D.D.T. at 2lb. of 100 per cent. an acre. New preparations of D.D.T. now in process of manufacture show that this dosage of D.D.T. will be available to the farmer at no increased acreage cost above that for B.H.C. Thus the 2lb. of D.D.T. per acre in superphosphate would give as good control as B.H.C. the first year and a much higher degree of control the second year after application, and in addition would also control grass-grubs for at least two successive seasons.

DIFFERENCES BETWEEN GRASS-GRUB AND SUBTERRANEAN GRASS CATERPILLAR, AND MOST IMPORTANT POINTS IN CONTROL

ODONTRIA (GRASS-GRUB)	*OXYCANUS* (SUBTERRANEAN GRASS CATERPILLAR)
Adults are small, shiny brown beetles, about ¼in. long.	Adults are about 1in. long and dull grey or brown moths.
Beetles emerge in November-January.	Moths emerge in October-November.
Beetles feed vigorously and cause economic damage	Moths cannot feed or cause damage.
Beetles do not lay eggs for 7 days after first mating.	Moths lay eggs almost immediately after first mating.
Eggs are large, white, and deposited deep in soil.	Eggs are small, at first white, but soon turn black; they are laid on ground surface.
Eggs depend for development on soil moisture at a depth of about 4in.	Eggs depend for development on surface moisture.
Grubs feed on roots and vegetable matter below ground surface.	Caterpillars feed on surface for first 4 to 6 weeks, but later construct tunnels into ground. They feed only on parts of plants above ground.
Grubs do not construct an open tunnel in the soil.	Caterpillars' tunnels are always open and free of debris, and tops are protected by fine soil particles held together by a light webbing.
Grubs feed day and night.	Caterpillars feed mainly at night, but may carry grass down tunnels and feed on this during the day.
Grub damage begins to show in January and continues until end of September and results in tufts of pasture being pulled up by grazing stock.	Caterpillar damage begins to show up in Canterbury after the first heavy rains after mid-February and continues until September. It results in completely bared ground without loose tufts of pasture.
Damage (not the grubs themselves) can be controlled by use of heavy rollers between May and end of August on flat land.	Damage not controlled by heavy rollers.
Grubs controlled by 1lb. of 100 per cent. D.D.T. or B.H.C. in 1000 gallons of water or by 1½ to 3½lb. of 100 per cent. D.D.T. or B.H.C. per acre in topdressing or dry soil.	Caterpillar controlled by 3½lb. of 13 per cent. B.H.C. in 1cwt. of superphosphate per acre or by 1lb. of 13 per cent. B.H.C. in 50lb. of bran per acre. (Use double strength for high-return crops.) Also controlled by 2lb. of paris green in 25 to 30lb. of bran for populations under 6 per square foot.

The Value of Early Ploughing

THE value of early ploughing is clearly demonstrated in the illustration above of a maize crop on the Gisborne flats.

Ploughing was started in this paddock in May, 1950, but had to be abandoned while there was still a strip down each side and the turning headlands to be done. The whole area was inundated by a flood early in July and was continually wet until December 10, when the paddock was cultivated with a tractor-mounted rotary hoe. Sides and headlands received a double cut at this stage to compensate for lack of ploughing.

The paddock was then harrowed, planted, and rolled, the whole receiving identical treatment and being sown with the same seed on the same date. The difference between the early-ploughed portion to the left and the strip to the right which was not cultivated until December is striking.

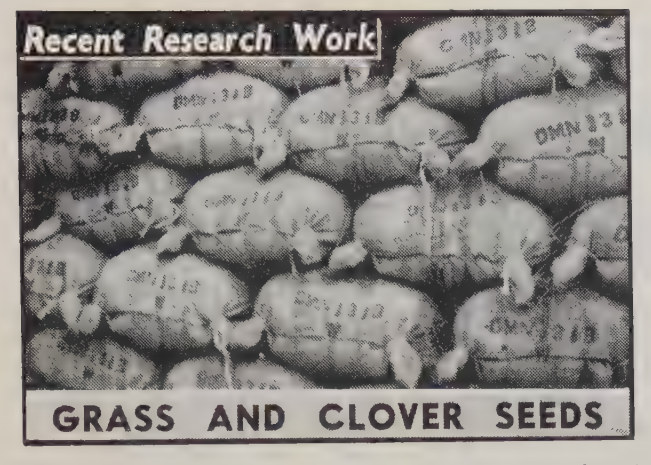
—G. J. GRAHAM, Department of Agriculture, Gisborne

References

8. "New Zealand Journal of Science and Technology", vol. 23, No. 5A, pp. 284-293, "Chemical Control of *Oxycanus cervinata* Walk.", L. J. Dumbleton and R. D. Dick (1942).

9. "New Zealand Journal of Science and Technology", vol. 27, No. 1A, pp. 32-36, "Ecological Observations on *Oxycanus cervinata*", R. D. Dick (1945).

10. "New Zealand Journal of Science and Technology", vol. 27, No. 2A, pp. 114-128, "Contributions to the Ecology of *Oxycanus cervinata* Walk.", L. J. Dumbleton (1945).



THE EXTENSION DIVISION of the Department of Agriculture is very closely associated with the production of grass and clover seeds, for the Division maintains the seed-certification service and seed-testing station, multiplies the nucleus seed supplies for commercial use, and carries out a great deal of investigational work aimed at improving methods of seed production and harvesting.

NITROGENOUS FERTILISERS

A CONSIDERABLE AREA has been devoted to grass-seed production in recent years and increasing use has been made of nitrogenous manures for topdressing such pastures. In the past sulphate of ammonia has been the chief source of nitrogen, but recent importations of ammonium nitrate-lime mixtures have shown promise when used for this purpose. In recent trials on pastures saved for ryegrass-seed production the ammonium nitrate-lime fertiliser has given greater increases than has sulphate of ammonia when each was applied at the same rate.

Experiments have shown that with conditions of low nitrogen status the seed production can be doubled by dressings of the order of 2cwt. per acre of sulphate of ammonia or ammonium nitrate-lime fertilisers on perennial ryegrass and cocksfoot. On Italian and short-rotation ryegrass topdressing at this rate causes excessive lodging, and dressings of 1cwt. per acre of nitrogenous fertilisers have proved more satisfactory. In Otago and Southland three trials were carried out with nitrogen applications to cocksfoot seed-production stands. On one area on the Taieri Plain which showed response very light yields were obtained because of dry spring conditions. At Dipton and Gorge Road responses were observed, but both stands were young.

It would appear that autumn applications would be to the advantage of older stands, whereas both young and old stands would benefit by a spring application of nitrogen. Further critical work is being undertaken on this important aspect of small-seeds production.

* * *

ABNORMAL SEEDS

THE PROPORTION of lines of red and white clover seed which on germination show a high percentage of seeds giving abnormal growths (and therefore unable to produce normal seedlings) has caused some concern. In the past 2 years an attempt was made to find the causes of such imperfect seeds by comprehensive surveys of factors thought to be connected with the incidence of such abnormal seeds and by three comprehensive trials. Two of the trials were on red clover seed crops and one on a white clover seed crop. They included comparisons of the effect of various settings of the header harvester and of the effect of the machine-dressing processes. Hand-rubbed seed was also examined for comparison.

WHITE CLOVER

THE TRIAL with white clover showed that the drum speeds and concave settings used did not markedly affect the amount of visible damage to the seed, though more seed was extracted with the highest drum speed. In apparently undamaged seed the differences between the amounts of abnormal seeds produced by various header settings were small, but the amount of hard seeds was reduced by increased drum speeds. The hand-rubbed seed had 93 per cent. of hard seeds. Visibly damaged seed had more abnormals. Of the drum speed comparisons the slowest gave fewest abnormals; however, when concave settings were compared the closest setting also gave fewest abnormals.

Hand-rubbed seed showing visible damage had fewer abnormals than the seed from the header harvester, but the amounts of hand-rubbed seed showing damage (17 per cent.) and the 15 per cent. of such seed giving rise to abnormal growths indicate that some factor such as insect damage must have been operating in the field.

RED CLOVER

THE HEADER HARVESTER was more severe on the seed in the red clover trials than in the white clover experiment, but the percentage of visibly damaged seed was only slightly lower in the hand-rubbed seed than in the seed threshed by the header harvester. However, when the apparently undamaged seed was germinated, that from the header harvester produced considerably more abnormals than the hand-rubbed seed, and increased drum speeds in particular had the effect of increasing the proportion of abnormal seeds. The same effect, to a more marked degree, was seen with the visibly damaged seed.

The trials showed that the setting of the header harvester was an important factor affecting the percentage of abnormal seeds in red clover, but was of less importance with white clover. Damage also occurred in the field before harvesting, probably as a result of insect attack. The effect of machine dressing red clover seed was a steady reduction in the percentage of hard seeds without marked effect on the amount of abnormals in the germinating seed.

SURVEY OF RED CLOVER

A SURVEY of 55 red clover seed crops was made at the 1950 harvest. The setting, make, and age of the header harvester used and the condition of the crop were noted and seed samples were taken for the determination of germination, visible damage, abnormal seeds, and moisture content. Results showed no significant effects caused by varying drum speeds or concave settings of the header harvester in the amount of damaged seed, hard seed, or abnormal growths. However, there was some indication that makes of header harvesters varied in threshing efficiency, and this probably obscured the influence of settings.

The moisture content of the seed at the time of threshing was an important factor. When the content was more than 8 per cent. the amounts of undamaged seed and of hard seeds both decreased with increasing moisture; that is, with higher moistures there was a greater scarifying action, which caused damage to some seeds, including hard seeds, and the superficially damaged hard seeds germinated more readily. The occurrence of abnormalities in the seedlings was not noticeably affected by moisture. Determination of the moisture content of the seed by observation of the crop was found difficult except in extreme cases.

As the yield of the fields increased, there was a marked tendency for the percentage of hard seeds to increase and for the percentage of germinating seed and normal-growth seedlings to decrease. Apparently the greater bulk of material passing through the machine in heavy crops prevented the seeds from being so severely scarified. Among the crops which were not direct headed there were no perceptible differences causd by variations of time the crops were in the paddock between cutting and threshing.

—P. B. LYNCH

* * *

HORMONE-TYPE WEEDKILLERS

THE USE of hormone weedkillers in ryegrass-seed crops was examined with two major aims—to determine whether the range of weeds found in ryegrass-seed crops could be controlled, and to determine the effect of hormone weedkillers on the germination of the grass seed produced subsequent to spraying. Trials showed that the principal weeds affecting ryegrass-seed crops, particularly in Hawkes Bay, could be controlled at low cost. The weeds, mainly hedge mustard, Scotch thistle, buttercup, burr clover, shepherd's purse, speedwell, fat-hen, and species of amaranthus, proved particularly susceptible to hormone weedkillers in the seedling stages. Further trials showed that, provided the crop was sprayed before flower-head formation, viability of the ryegrass seed was not affected.

Low-volume spraying demonstrated in trial work, now enables up to 80 acres of ryegrass-seed crop to be sprayed per day at a cost of 5s. per acre for materials. Weed control is excellent, because weeds are sprayed at their most susceptible stage, and this early spraying eliminates the risk of damaging the viability of the seed produced. The most economical and efficient method is to remove the stock for a short period about the end of August or early September and then spray with the hormone weedkiller.

—L. J. MATTHEWS

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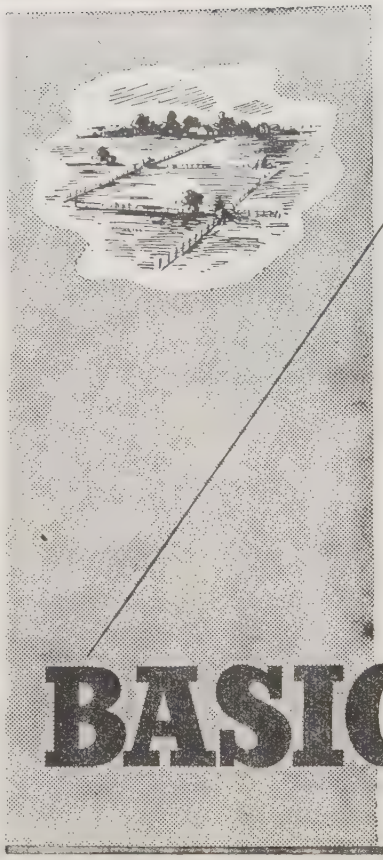

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HYDATIDS *must be stamped out!*

16.5

POISONOUS PLANTS IN NEW ZEALAND

THIS is the twelfth and final section of a series of descriptions of poisonous plants which grow in New Zealand by H. E. Connor, Botanist, Department of Scientific and Industrial Research, Wellington, which has been appearing monthly in the "Journal". On page 205 is a synopsis showing the comparative toxicity of the plants which have been dealt with, and on page 206 they are classified into trees, shrubs, and herbs. Glossaries to be used with the series were published with the first section, which appeared in the October, 1950, issue.

GYMNOSPERMS

Taxaceae

Yew. *Taxus baccata* **L. (Fig. 25)**

Botanical description: Habit—Tree up to 60ft. tall; bark reddish, flaky, deeply fissured in old trees; branches spreading to form a broad, low head. **Leaves**—Two-ranked, linear, usually falcate, shortly pointed, dark green above, paler beneath, ¾-1¼in. long. **Flowers**—Male and female cones on separate trees, solitary and axillary, small. **Fruit**—One-third to ½in. in diameter, with an almost globose, fleshy, scarlet disc; seed broadly ellipsoid, brown, ¼in. long. (North temperate region.)

Distribution: Grown throughout New Zealand as hedges and as single trees in gardens.

General: Poisonings by yew among cattle and calves have been reported in New Zealand on several occasions, and poisonings are not infrequent in cattle, horses, and pigs in England and on the Continent. The leaves, bark, and seeds are known to be poisonous, though usually the leaves are the only part eaten. Frequently, as with other cases of poisoning by garden trees and shrubs, trimmings are disposed of over fences where they are easily accessible to cattle, and deaths follow rapidly when toxic doses are eaten.

Symptoms of poisoning: When sublethal doses are eaten symptoms visible under very close observation are a slight rise in temperature and a little excitement. Lethal doses cause pronounced excitement, nausea and vomiting, trembling, staggering, and then death. Cattle chewing the cud often drop dead "as if they had been shot". Post-mortem examination shows the stomach distended and inflamed and the liver, spleen, and lungs engorged with blood.

Poisonous principle: The alkaloid taxine present in the plant is the poisonous principle. In addition the plant contains the volatile oil of yew and traces of ephedrine and hydrocyanic acid, but the chief toxic action is that of the non-irritant alkaloid taxine.

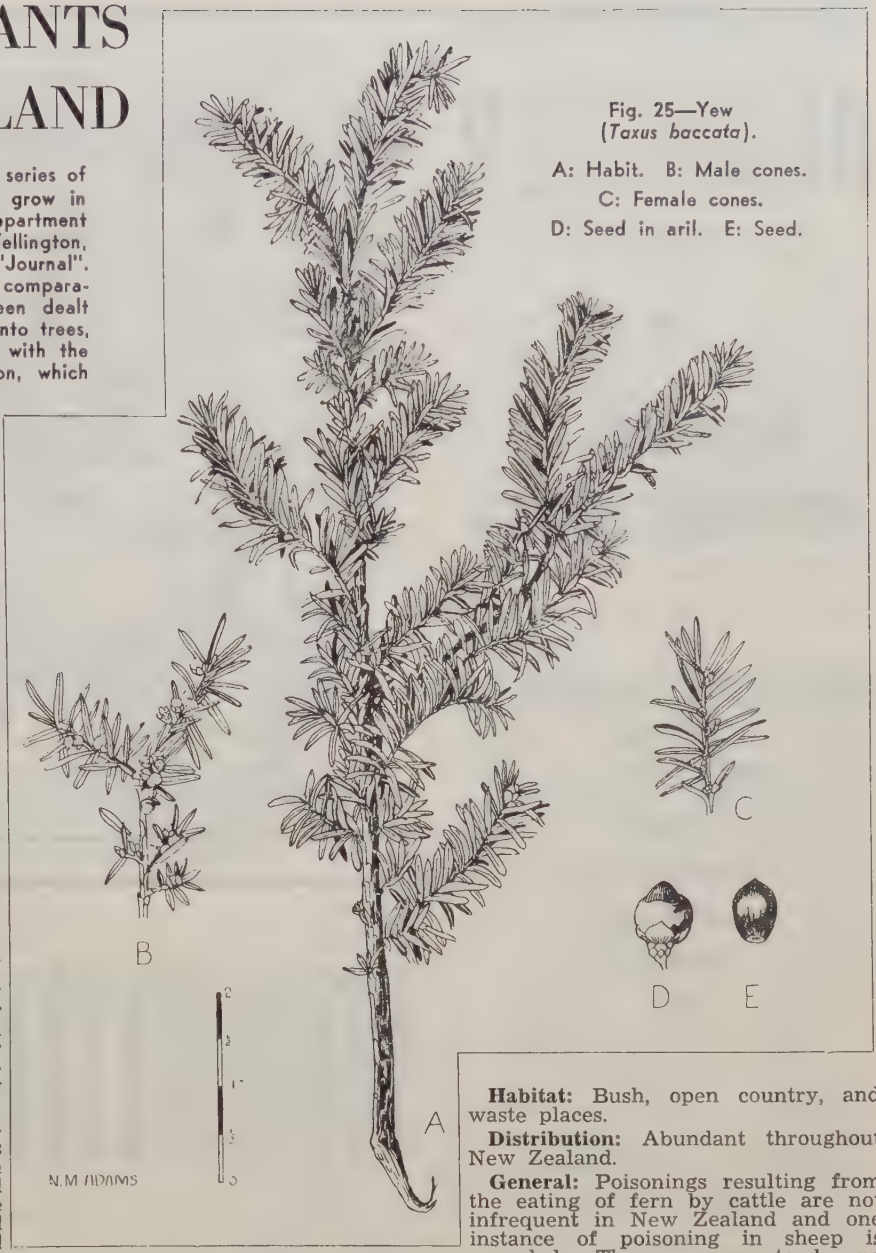

Fig. 25—Yew (*Taxus baccata*).
A: Habit. B: Male cones.
C: Female cones.
D: Seed in aril. E: Seed.

FERNS

Bracken Fern. *Pteridium aquilinum* **var.** *esculentum* **(Forst. f.) Kuhn. (Fig. 26)**

Botanical description: Habit—Rhizome stout, creeping, much branched, often matted, subterranean, producing numerous scattered fronds. Stipes variable in length, stout, rigid, erect, brown, smooth, and shining. Fronds usually 2 to 6ft. long including the stipes, but often up to 12ft., broadly deltoid in outline, coriaceous, glabrous or nearly so when mature, usually more or less rusty pubescent when young, especially on the under surface, 3 to 4 pinnate, rachises grooved above, usually pubescent. **Pinnae**—Primary broad, distant, spreading, the lowest pair the largest and most compound, the upper ones gradually decreasing in size; secondary and tertiary lanceolate, always terminating in a linear, obtuse, undivided segment; ultimate segments linear or linear-oblong, decurrent at the base. Sori usually continuous all round the segment. (New Zealand.)

Habitat: Bush, open country, and waste places.

Distribution: Abundant throughout New Zealand.

General: Poisonings resulting from the eating of fern by cattle are not infrequent in New Zealand and one instance of poisoning in sheep is recorded. There appears to be no explanation for the facts that some cattle will leave good pasture to eat fern fronds and that stock effectively crush fern in some localities. It has been suggested that poisoning is cumulative and that toxic symptoms are not produced immediately; it is also contended that an immunity to fern poisoning can be built up by the animals. Despite the large numbers of stock which avoid the toxic effects of fern, this plant has considerable importance in the poisonous plant flora of New Zealand.

Symptoms of poisoning: Affected animals show lack of thrift, dullness, emaciation, loss of appetite, and discharge of blood from the rectum with the faeces. Post-mortem examination shows severe hemorrhagic gastroenteritis.

Poisonous principle: Not known.

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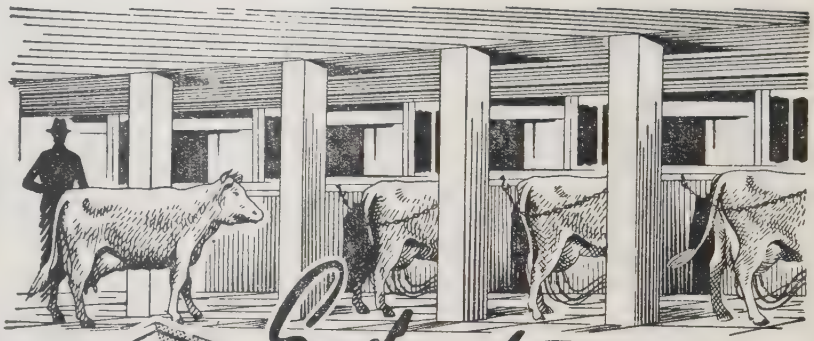

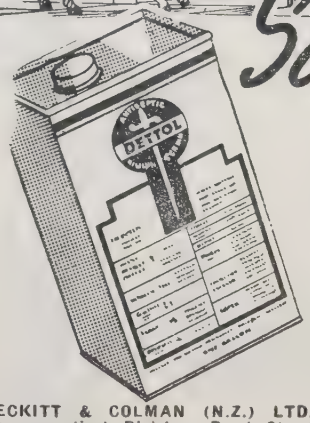

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Paspalum ergot. *Claviceps paspali* **Stevens et Hall**

Botanical description: Ergots of paspalum are irregularly spherical, dusky or pinkish white on the outsides and insides. The ergots are parasitic only on paspalum and usurp the positions of the seeds in the florets. The honeydew phase of the life cycle is the very common sticky-headed stage.

Habitat: Paspalum flowers only.

Distribution: More common in the northern half of the North Island, but extends to the northern part of the South Island.

General: In 1935 a staggering condition was reported in New Zealand in stock which had grazed paspalum infected with *Claviceps paspali*; these staggers were apparent when the animals were forced to move, but were not noticeable when they were left alone. Recovery is rapid if stock are shifted to new pasture or fed on hay. Reports from overseas show that paspalum ergot may cause staggers or even complete paralysis. The animals affected were mainly cattle, but some trouble appeared in horses. Feeding trials at the Animal Research Station, Wallaceville, showed that the seed heads infected with the paspalum ergot sclerotia produced the staggers observed in the field. Paspalum staggers have been reported again in New Zealand recently.

Symptoms of poisoning were trembling of body and, when the animals were moved, definite ataxia. When the animals were frightened so that they attempted to run they fell over in curious attitudes.

Poisonous principle: Not known.

Ergot. *Claviceps purpurea* **Tull.**

Botanical description: Parasitic in the young ovaries of grasses, including ryegrass, tall fescue, and marram grass. At the mycelial stage honey dew, a sticky substance, is secreted. Elongate, dark violet sclerotia eventually protrude from the floret, occupying the position normally held by the seeds. This dark resting body—sclerotium—is the ergot of pharmacy and causes poisonings.

Habitat: Parasitic on the grasses mentioned.

Distribution: Common throughout New Zealand.

General: Poisonings by ergot among man and livestock have been recognised for a considerable time. In New Zealand ergotism in livestock is restricted to cattle and horses; sheep have been ergotised experimentally, but the condition is not known to appear in the field. Ergotism of stock in New Zealand is not frequent, but poisonings are recorded. The effects of ergot are not rapid in appearance. Ergotism is produced in man in two

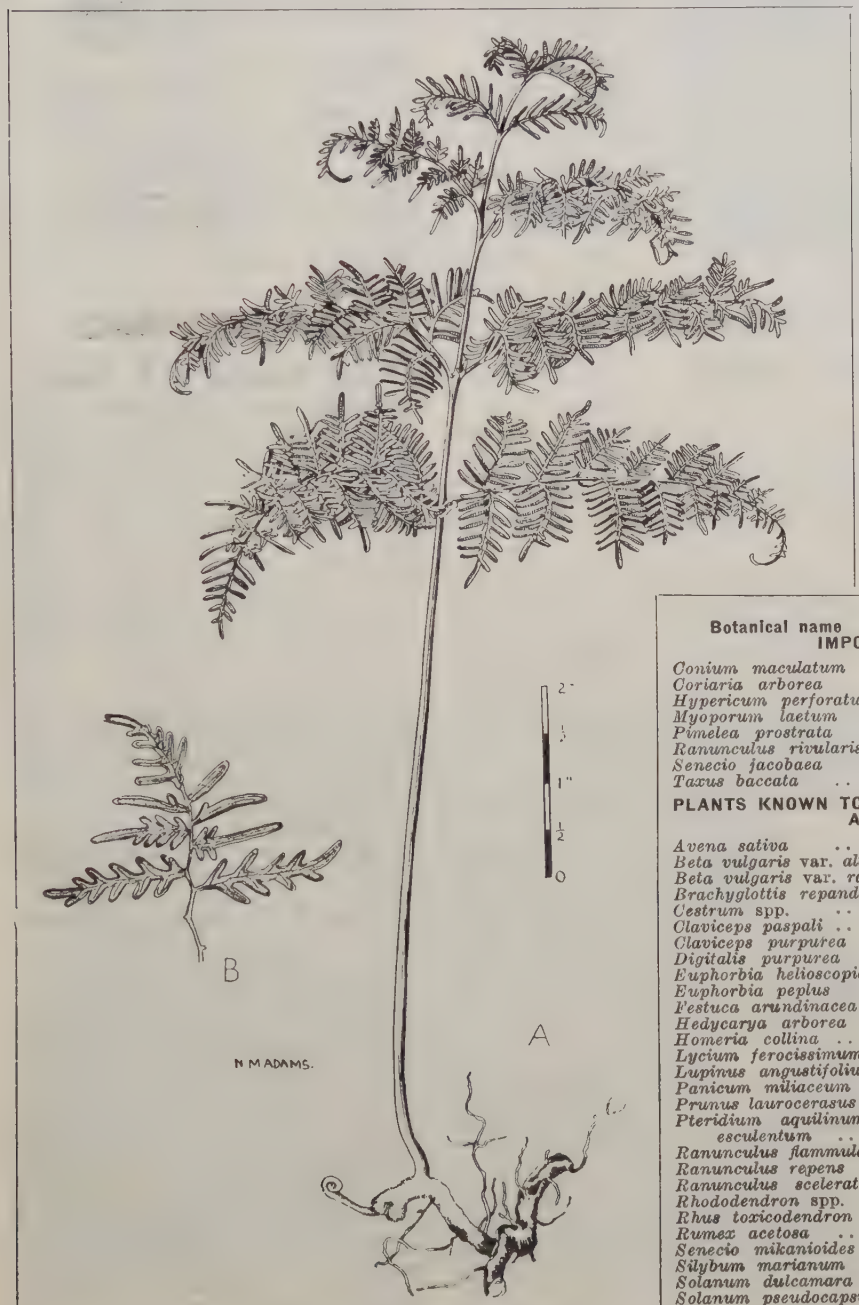


Fig. 26—Fern (*Pteridium aquilinum* var. *esculentum*). A: Habit. B: Under surface of leaf showing sori containing spores.

Botanical name	Common name	Status
IMPORTANT POISONOUS PLANTS		
Conium maculatum	Hemlock	Introduced
Coriaria arborea	Tutu	Native
Hypericum perforatum	St. John's wort	Introduced
Myoporum laetum	Ngaio	Native
Pimelea prostrata	Strathmore weed	Native
Ranunculus rivularis	Waoriki	Native
Senecio jacobaea	Ragwort	Introduced
Taxus baccata	Yew	Introduced
PLANTS KNOWN TO BE POISONOUS, BUT NOT AS IMPORTANT AS THOSE LISTED ABOVE		
Avena sativa	Oat	Introduced
Beta vulgaris var. *altissima*	Sugar beet	Introduced
Beta vulgaris var. *rapa*	Mangold	Introduced
Brachyglottis repanda	Rangiora	Native
Cestrum spp.	Cestrum	Introduced
Claviceps paspali	Ergot of paspalum	Introduced
Claviceps purpurea	Ergot	Introduced
Digitalis purpurea	Foxglove	Introduced
Euphorbia helioscopia	Sun spurge	Introduced
Euphorbia peplus	Milkweed	Introduced
Festuca arundinacea	Tall fescue	Introduced
Hedycarya arborea	Pigeonwood	Native
Homeria collina	Cape tulip	Introduced
Lycium ferocissimum	African boxthorn	Introduced
Lupinus angustifolius	Blue lupin	Introduced
Panicum miliaceum	Broomcorn millet	Introduced
Prunus laurocerasus	Cherry laurel	Introduced
Pteridium aquilinum var. *esculentum*	Fern, bracken	Native
Ranunculus flammula	Lesser spearwort	Introduced
Ranunculus repens	Creeping buttercup	Introduced
Ranunculus sceleratus	Celery-leaved buttercup	Introduced
Rhododendron spp.	Rhododendron	Introduced
Rhus toxicodendron	Poison ivy	Introduced
Rumex acetosa	Sour dock	Introduced
Senecio mikanioides	Cape ivy	Introduced
Silybum marianum	Variegated thistle	Introduced
Solanum dulcamara	Bittersweet	Introduced
Solanum pseudocapsicum	Jerusalem cherry	Introduced
Solanum tuberosum	Potato	Introduced
Urtica ferox	Ongaonga	Native
PLANTS SUSPECTED OF BEING POISONOUS		
Rumex acetosella	Sheep sorrel	Introduced

clinically distinct types, one gangrenous and the other convulsive; the gangrenous type is that seen in stock. Feeding trials in New Zealand with cattle have produced the gangrenous symptoms observed in the field. It has been concluded from a detailed study that "milk or meat of cattle which ingest ergot with their fodder is not unsafe for human consumption".

Symptoms of poisoning: Swelling of the fetlocks and lameness are symptoms in cattle, the hind feet being affected first; sensation is lost in the affected part, dry gangrene sets in, and eventually parts may be sloughed without pain; an indented line on the fetlock demarks the limit of the gangrene. The tail of a bovine is affected similarly. In experimental poisoning of sheep the most consistent lesion was inflammation and ulceration of the tip of the tongue and of the mucosa of the alimentary tract.

Poisonous principle: The alkaloids ergotoxine and ergotamine, of the five pharmacologically active ergot alkaloids present, are considered those responsible for the gangrenous symptoms.

Classification of Poisonous and Suspected Poisonous Plants into Trees, Shrubs, and Herbs

TREES

Rangiora	*Brachyglottis repanda**
Cestrum	*Cestrum* spp.*
Tutu	*Coriaria arborea**
Pigeonwood	*Hedycarya arborea*
Cherry laurel	*Prunus laurocerasus**
Ngaio	*Myoporum laetum**
Yew	*Taxus baccata*

SHRUBS

Rangiora	*Brachyglottis repanda*
Cestrum	*Cestrum* spp.
Tutu	*Coriaria arborea*
African boxthorn	*Lycium ferocissimum*
Ngaio	*Myoporum laetum*
Strathmore weed	*Pimelea prostrata*
Cherry laurel	*Prunus laurocerasus*
Rhododendron	*Rhododendron* spp.
Poison ivy	*Rhus toxicodendron*†
Bittersweet	*Solanum dulcamara*†
Jerusalem cherry	*Solanum pseudocapsicum*
Tree nettle	*Urtica ferox*

PARASITIC FUNGI

Ergot of paspalum	*Claviceps paspali*
Ergot	*Claviceps purpurea*

HERBS

Oat	*Avena sativa*
Sugar beet	*Beta vulgaris* var. *altissima*
Mangold	*Beta vulgaris* var. *rapa*
Hemlock	*Conium maculatum*
Foxglove	*Digitalis purpurea*
Sun spurge	*Euphorbia helioscopia*
Milkweed	*Euphorbia peplus*
Tall fescue	*Festuca arundinacea*
Cape tulip	*Homeria collina*
St. John's wort	*Hypericum perforatum*
Blue lupin	*Lupinus angustifolius*
Broomcorn millet	*Panicum miliaceum*
Fern, bracken	*Pteridium aquilinum* var. *esculentum*
Lesser spearwort	*Ranunculus flammula*
Creeping buttercup	*Ranunculus repens*
Waoriki	*Ranunculus rivularis*
Celery-leaved buttercup	*Ranunculus sceleratus*
Sour dock	*Rumex acetosa*
Sorrel	*Rumex acetosella*
Ragwort	*Senecio jacobaea*
Cape ivy	*Senecio mikanioides*†
Variegated thistle	*Silybum marianum*
Potato	*Solanum tuberosum*

* Often a shrub. † Climbing plant or liane.

Reduced Strength of Cobaltised Fertiliser in the North Island

DURING the last 12 years there has been a very great increase in the use of cobaltised fertilisers in New Zealand. In 1948 approximately 50 tons of cobalt sulphate was incorporated in cobaltised fertilisers. Last year the quantity had increased to 160 tons, and there is evidence that the demand is still increasing. Unfortunately, the world supply of cobalt is limited, and some difficulty is already being experienced in obtaining requirements.

EXTENSIVE research backed by even more extensive field experience has shown that cobalt deficiency can be effectively remedied by the application of 5oz. of cobalt sulphate per acre annually. This is approximately the amount contained in 1cwt. of cobaltised fertiliser, which has hitherto contained 6lb. of cobalt sulphate per ton of fertiliser. In North Island districts it is usual to apply at least 2cwt. of superphosphate or other phosphatic fertiliser per acre, and this has resulted in a considerable wastage of cobalt.

Because of the urgent need to economise in the use of cobalt, it has now been decided that as from September 1, 1951, cobaltised fertilisers from all North Island works will contain only 3lb. of cobalt sulphate per ton of fertiliser. The application annually of 2cwt. per acre of such cobaltised fertiliser will quite effectively remedy cobalt deficiency.

Unfortunately manufacturers are unable, with their present facilities, to supply more than one grade of cobaltised fertiliser. In the few cases where less than 2cwt. of cobaltised fertiliser per acre is used in the North Island it will therefore be necessary to incorporate additional cobalt in the fertiliser, or to spray cobalt on the land in the form of a solution. Any farmer wishing to do this should seek advice from the nearest office of the Department of Agriculture.

Because of the lower rate of topdressing in South Island districts, cobaltised fertiliser from South Island works will continue to contain 6lb. of cobalt sulphate per ton of fertiliser. Consequently in South Island districts where more than 1cwt. of fertiliser is applied annually, only 1cwt. need be cobaltised. It is not necessary to mix the cobaltised and uncobaltised fertiliser very accurately. If half of each is being used, it will be quite satisfactory if bags of each kind are tipped into the topdresser alternately.

FILM: "Better Pigs, Bigger Profits"

An outline of how, under conditions of free choice, consumer preference dictates the quality of pork and bacon required on the market and how this preference is reflected back to the producer through a commercial grading system is given in a new film, "Better Pigs, Bigger Profits", which has been produced in New Zealand by Apex Films (N.Z.) Ltd. and sponsored by the National Pig Council in association with trade organisations. The film indicates how by producing the type of carcass which gives the desired quality of meat, farmers not only safeguard their markets but secure bigger profits.

Stages in the production of a profitable line of pigs which turn out high-quality carcasses are shown and much of the film deals with husbandry practices from the weaning of one litter to the farrowing, weaning, and fattening of the next.

The film is designed for use at meetings of pig producers and farmers generally where it can be followed by film-strip lectures on subjects which are raised by the film but on which further discussion is desired.

Applications for screenings should be made through secretaries of local district pig councils or direct to the Visual Aids Officer, Department of Agriculture, P.O. Box 3004, Wellington, C1.

16mm., black and white with sound, 22 minutes.

—*A.L.*

BOOK REVIEW

"Crop Varieties": H. Hunter

THE first impression created by the publication "Crop Varieties" is that its contents, based on varieties grown in England, may have little application in New Zealand. On further study, however, it is apparent that the notes on varieties themselves are but a portion of the information it contains. The reader is supplied with a historical and practical survey of modern methods of producing and maintaining high quality in agricultural seeds, which has a value irrespective of any interest there might be in the individual varieties described.

Separate chapters are devoted to the various cereals, and to field beans and field peas, flax (for fibre and linseed), and potatoes, while a chapter also deals with pure seed and schemes of cereal seed certification in some European countries.

Those interested in practical production or in scientific plant improvement will find in this book information of value. —*J.H.C.*

E. and F. N. Spon Ltd., London. 21s. net.

"FARM WATER SUPPLIES"

Because a piped water supply is essential in most branches of farming, the correct establishment and maintenance of a farm water supply system is of prime importance. In a new bulletin, "Farm Water Supplies", issued by the Department of Agriculture, H. W. T. Eggers explains the principles governing the operation of a water supply system and describes all the equipment used in a farm water supply system and how it should be installed and maintained. A chapter in the bulletin is devoted to the description of the construction of a farm pond which can be built by a farmer from soil with his own tractor and implements.

Copies of "Farm Water Supplies", which is free, are obtainable from the nearest office of the Department.

The Brown Snail (*Helix aspersa*)

By J. A. CEDERMAN, Orchard Instructor, Department of Agriculture, Kaikohe

THE common brown snail is a serious garden pest in all districts of New Zealand. It is not a native, but was probably introduced into New Zealand in the early days on the roots of plants and trees from the British Isles or the Continent of Europe. The snail belongs to a distinct group of the animal sub-kingdom *Invertebrata*; this group, *Phullum mollusca*, covers a great number of shellfish. Those species which have a foot as a locomotory organ and, as in the snail, a single spiral shell are classed as gastropods. Many species of snail are marine animals; others inhabit fresh-water streams and rivers, and a few species, including the brown snail, have forsaken the water and adapted themselves to a terrestrial life.

THE brown snail lays small clusters of white eggs in a moist topsoil rich in humus or in heaps of well-decomposed plant material such as leaf mould and compost. The spherical eggs are about 3 mm. in diameter and have shells of albumen-like substance impregnated with calcium salts. A sticky outer coating holds the cluster together.

In warm, moist conditions the eggs hatch in from 10 to 20 days. Unfavourable soil and weather will retard hatching and may, if prolonged, destroy viability. The newly emerged snails are white and are already fitted with shells. A gradual change of colour toward that of the adult occurs over the first 3 months. During this period the young snails stay close together in small colonies; then they scatter in their search for food.

The shell of the adult snail is most conspicuous, being brown with pale zig-zag markings. The structure is a low wide spiral with a small grey peak. Shells are composed of carbonate of lime with a small proportion of animal matter; this may well be one reason why snails prefer to feed on lime-loving plants. During hibernation and when disturbed or resting the soft body of the snail is drawn into its shell.

The soft, flattened underside of the body is called the foot. The snail moves about by the expansion and contraction of the foot muscles. Mucus secreted by the foot during movement forms a silver-grey track which often betrays a hiding place.

Damage to the cabbage plant shown is typical of that caused by slugs and snails. In some instances only the upper surface of the leaf blade is eaten. Many of the snails on this plant would probably hide at the bases of the leaves or stem during the day.

Two pairs of tentacles are carried on the head at the front of the foot, one pair acting as hands or feelers and the other, the long upper pair, carrying the eyes at the tip. The mouth, placed beneath these feelers, has external fleshy lips and a rasp-like tongue, fitted with rows of teeth, which lacerates the plant tissues so thoroughly that further mastication is unnecessary.

Both sexes are combined in one snail, but cross-fertilisation is still necessary. Snails are well equipped with sense organs, especially those of balance and smell.

The snails lie quietly in a sheltered spot during the day and at night move out to feed on plants; on wet days they often continue to feed, but stay close to shelter. In captivity snails have lived for 2 years without food. Cold does not affect them seriously, due to their decreased activity. During hot, dry summer weather the snail secretes a protective membrane over the mouth and remains completely inactive.

Hiding places for snails during hibernation or in the daytime. The importance of clean cultivation and garden hygiene is demonstrated by the use to which the weed growth (left) and the bricks (right) are put by snails.

Egg laying takes place in spring and summer and is limited to one generation per year. The adult stage is normally reached in the following spring, but may be retarded by unfavourable conditions.

One large snail can behead a young seedling overnight, and even large plants may be seriously damaged by persistent attacks. It is quite common for snails to shelter during the day among the foliage of a selected host plant. Snails are prey for many kinds of birds, especially thrushes, which often carry them to a stone and break the shell by hitting it on the stone. The luminous larva of a glow-worm also feeds on snails.

Control Measures

The following control measures are suggested for the brown snail and apply equally well to other snails and slugs.

1. A special effort should be made at least once a year to clean the garden of all but cultivated plants by digging over all unplanted areas and maintaining clean cultivation between the growing plants, trimming all hedges, and removing, burying, or burning all unnecessary materials such as boards, sacks, dead plant growth, and any other type of garden surplus. If every gardener practised this simple but complete garden hygiene for a short period each spring, and, better still, if the effort were collective, the incidence of many garden diseases and pests would be tremendously reduced.

2. Keep the ground as dry as possible. In the event of a serious outbreak of the pest avoid the application of organic manures for a period.

3. Water with D.D.T. liquid, D.D.T. emulsion, or D.D.T. wettable powder, using high concentrations of 16 per cent. or over for the liquid, 20 per cent. or over for the emulsion, and 25 per cent. or over for the wettable powder. Dilute to 0.2 per cent., applying at the rate of 2 gallons per square yard.

4. Use some type of poison bait, the baits being made up of a material which encourages attention and also contains a poison such as metaldehyde, sodium arsenate, or paris green. Many suitable preparations are now being marketed, and most of them seem to be effective.

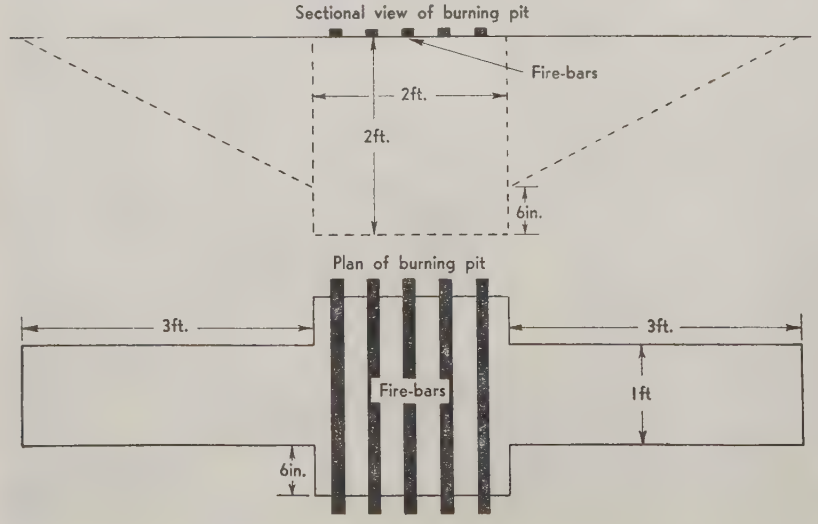
5. A natural trap is a piece of sacking, a slightly raised board, or even waste cardboard and paper, the catch being destroyed on the following day. Hand collecting is a positive method of attack.

6. Dry materials to repel or kill the invaders are commonly applied. These include burnt or slaked lime, salt and lime, soot and lime, caustic soda and lime, barley sweepings, and cinders and powdered coke. Encircling plants with such material forms an effective barrier, but repeated use will ruin the soil structure and will be harmful to the plants. Certain ornamentals will not tolerate the alkaline effect of lime, salt, soot, or caustic soda.

Burning Pit for Destroying Dead Animals

TO leave dead animals to decompose is to invite trouble and to bury them satisfactorily is tedious work; burning is the best means of disposing of them, but to burn carcasses on the flat or on a hill requires a good deal of firing and attention. The burning pit illustrated is easily constructed and can be dug in any situation without regard to prevailing wind draughts.

Starting from ground level, dig a trench 1ft. wide and sinking to a depth of 1ft. 6in. at 3ft.; then dig a hole 2ft. x 2ft. x 2ft. for the fire-box and dig another trench on the opposite side of the first trench, 1ft. 6in. deep at the fire-box end and sloping upward to ground level at the end of 3ft. This inward-sloping trench gives an extreme through draught. The fire-box in the centre of the trench is 6in. deeper than the deepest part of the trench and will easily hold sufficient wood to burn 5 or 6 sheep at one time. To complete the pit 5 or 6 fire-bars, laid not more than 4 to 6in. apart, are required. They are placed across the top of the fire-box and it is on them that carcasses are placed.



Once the fat starts to burn the strong draught caused by the shape of the trench will assist in burning the carcasses entirely with the use of little fuel.

—J. G. BALL, Sheep and Wool Instructor,
Department of Agriculture, Wanganui

BOOK REVIEW

"Moisture Requirements in Agriculture — Farm Irrigation": H. B. Roe

PROFESSOR ROE, of the University of Minnesota, has dealt fully with most aspects of irrigation in the United States of America, giving fairly complete specifications not only for the machinery and equipment in use but also for the correct watering of crops in varying circumstances.

The increasing use being made of irrigation water in New Zealand would make the book useful as a textbook for students, technicians, and engineers associated with irrigation layout. For the irrigating farmer the information may be somewhat technical and based so much on the American practice of crop irrigation as to restrict its value where pasture irrigation becomes the dominant interest. But although the material has been drawn largely from the author's experience in teaching engineering students the principles and practices of soil moisture regulation, it is obvious that he is fully conversant with farmers' problems under irrigation and the practical side receives a good deal of attention.

—J.W.W.

McGraw-Hill International Corporation, New York. $5.50.

Radio Broadcasts

A RADIO broadcast will be given to farmers from Station 1YZ Rotorua at 7.15 p.m. as follows:—

October 11—"Seasonal Work for the Pumice Country Farmer", by C. R. Taylor, Fields Instructor, Department of Agriculture, Rotorua.

The following broadcast will be given from Station 3YA Christchurch at 7.15 p.m.:—

October 11—"Harvesting Small Seeds", by R. G. Jolly, Fields Instructor, Department of Agriculture, Christchurch.

Broadcasts will be given from Station 4YZ Invercargill at 7.15 p.m. as follows:—

October 8—"Vegetable Growing", by D. Wilson, Orchard Instructor, Department of Agriculture, Invercargill.

October 29—"Wool", by W. F. Dick, Sheep and Wool Instructor, Department of Agriculture, Invercargill.

Other talks are given from 1YA Auckland on Tuesdays at 12.35 p.m., 1YD Auckland on Thursdays at 7.30 p.m., 1XN Whangarei on Mondays and Wednesdays at 8.10 p.m., 1XH Hamilton on Mondays at 8.45 p.m., 2YZ Napier on Tuesdays at 7.10 p.m., 2YA Wellington on Thursdays at 12.35 p.m., 3YA Christchurch on Mondays at 12.20 p.m., 4YA Dunedin on Thursdays at 12.35 p.m., and 4YZ Invercargill on Mondays at 12.35 p.m.

Spread of Virus Diseases in Potato Crops

By J. H. CLARIDGE, Superintendent of the Seed Industry, Department of Agriculture, Wellington

THAT degeneration of potato stocks takes place has long been recognised, but only about the time of the First World War did the cause of this degeneration become known. It is not, as was at first thought, caused by continuous vegetative reproduction, but is brought about by the onslaught of a group of diseases classified as virus diseases. These diseases are the chief factor in bringing about loss of vigour and reduced yielding ability in potato stocks.

FOR purposes of certification it is sufficient if virus-infected potato plants can be classified into one of three groups—leaf roll, mild mosaic, or severe mosaic—according to the symptoms shown in the foliage. To understand how the diseases are spread, however, some more specific knowledge of the behaviour of each virus is necessary.

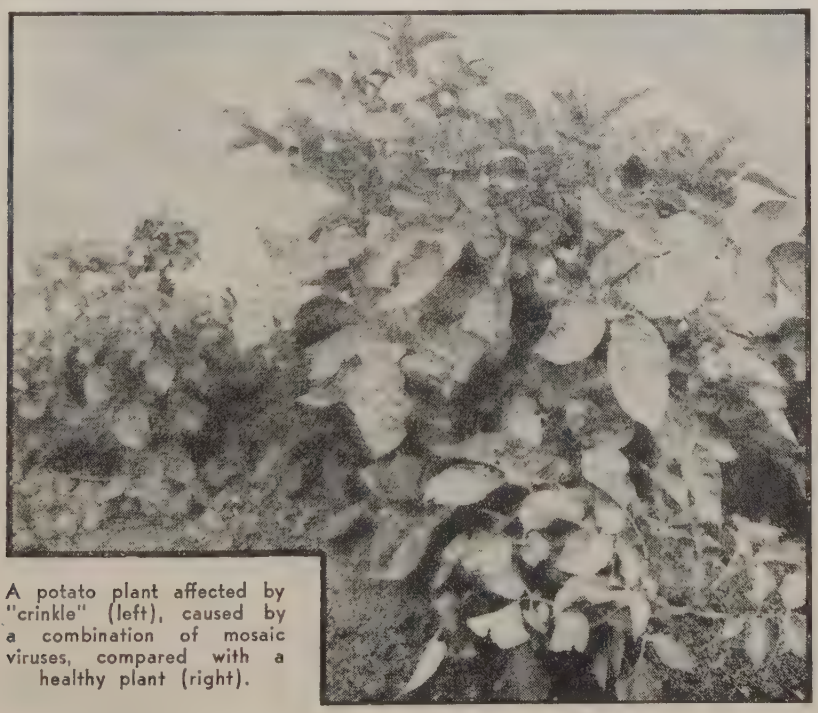
Symptoms shown by potato plants are not constant for the same virus. For instance, symptoms caused in different varieties may vary widely: One variety may be immune to the virus, a second may carry it without any apparent effect, a third may show "typical" symptoms, while a fourth may react so severely to infection that the plant tissue surrounding the infection point is killed, thus causing a lethal necrosis and isolating the virus almost at its source. Again, symptoms shown by a variety growing under one set of conditions may not agree with those shown by the same variety under different conditions. In an extreme case the virus may be completely masked in one instance and be readily identifiable in another.

A potato plant showing typical symptoms of attack by leaf-roll virus.

Two Kinds of Infection

Virus infection is of two kinds: Primary infection is that occurring when the plant foliage has become infected from an outside source during the growing period; secondary infection is that occurring in the foliage of a plant grown from an infected tuber. Symptoms differ in the two types of infection and, indeed, symptoms of primary infection are seldom observed.

To complicate the issue still further, a plant may be infected with more than one virus. The symptoms then are generally more severe than when one virus is present alone.



A potato plant affected by "crinkle" (left), caused by a combination of mosaic viruses, compared with a healthy plant (right).

Leaf-roll Virus

The behaviour of the leaf-roll virus is relatively straightforward, and plants with secondary infection usually show a characteristic and easily recognised harshness and upward rolling of the lower leaves. Some varieties appear to resist infection by leaf-roll virus; some, though easily infected, appear to be tolerant of its effect; others quickly succumb to infection and become markedly stunted and reduced in vigour.

The most important agent in the spread of leaf-roll virus from plant to plant in the field is the aphis *Myzus persicae*. Tubers from diseased plants carry the disease over from season to season. The symptoms of leaf roll are not greatly modified by the presence of another virus in the plant.

The Mosaic Group

The virus diseases of the mosaic group are caused by several distinct viruses alone or in combination. The three mosaic viruses of major importance commercially have been given various names, but for simplicity they are perhaps best identified by the symbols A, X, and Y.

Virus X, or simple mosaic virus, is present to some degree in most commercial potato stocks, but because of the mild symptoms it causes its presence is rarely noticed in the field. In some varieties the virus is carried without external symptoms, while in others it may cause a faint but distinct mottling without reduction in plant vigour. Despite these negligible symptoms, Australian research workers have shown that the presence of the virus can reduce the yielding ability of a plant by as much as 20 per cent.

Virus X is not transmitted by aphides, but is spread in the field by direct contact between diseased and healthy plants and is carried over in tubers from infected plants. Several strains of virus X which show differences in the severity of the symptoms caused have been identified, and a plant infected by one strain cannot then be infected by another.

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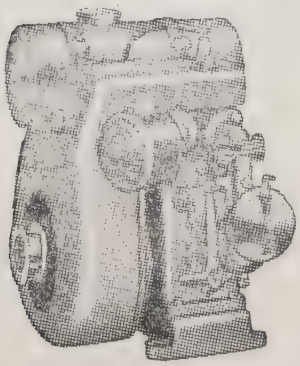

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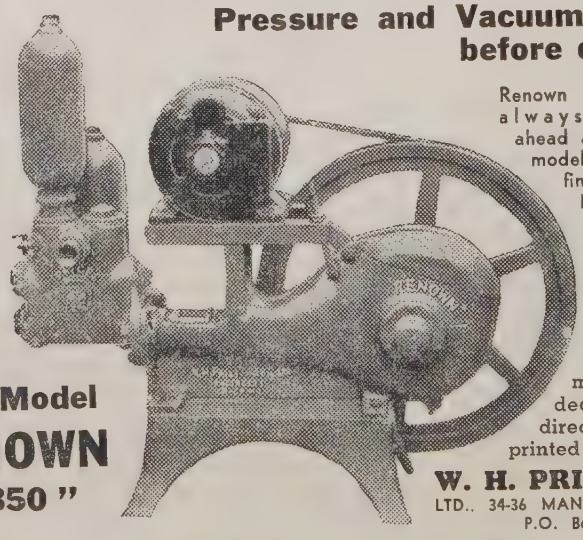

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The viruses A and Y are somewhat similar in their reactions, the symptoms they cause varying in different varieties from a faint mottling of the foliage to a necrosis of the leaves which may result even in the death of the infected plant. Both are transmitted from diseased to healthy plants in the field by the aphis *Myzus persicae*. Virus A is transmitted by other aphides also, but is the more difficult to convey from diseased to healthy plants. Tubers from infected plants carry infection into the succeeding crop.

In some varieties the primary infection of virus Y, or leaf-drop streak virus, causes a blotching in the topmost leaflets to develop within a few weeks and spread along the veins. This necrosis may spread to the whole leaf, causing it to wither and hang limply from the main stem. In varieties showing severe symptoms of attack by virus A the tubers also may show severe necrosis.

Mosaic Viruses in Combination

Viruses A and Y frequently occur in combination with virus X, and these combinations are usually responsible for the more severe forms of mosaic observed in the field. Viruses X and A in combination usually produce a severe form of mosaic causing a marked reduction in plant vigour and a distinct mottling and crinkling of the leaflets. The condition is normally termed "crinkle". The combination of viruses X and Y also produces a stunted plant not unlike that caused by X plus A, but the leaflets infected by the latter combination lack the heavy mottling and wavy margins; the term "rugose mosaic" is used to describe the symptoms of this combination.

Spread in Commercial Crops

The descriptions given are not intended to present the full story of potato viruses, but only to stress how complex is the problem and to give a background to the more topical question of their spread in commercial crops.

The two main factors influencing the spread of virus diseases in the field and the suitability of crops from which to save tubers for seed are locality and isolation.

Effect of Locality

Locality in its widest sense is important for two reasons: It is the factor governing the intensity of the aphis population in the crop, and through its influence on tuber size it also contributes to the proportion of infected tubers among those saved for seed.

Some interesting trials investigating the effect of locality on the yield and virus infection of the resultant crop have been carried out by the Department of Agriculture. "The Journal of Agriculture" for February, 1935, reported some of the results, and the table on this page summarises those of an additional trial, at that time in progress.

Overseas investigations, confirmed by trial and observation in New Zealand, make the following points very clear:—

A high aphis population, particularly of the winged form and early in the season, causes a greater spread of virus within the crop than does a low aphis population.

The four factors restricting aphis population are high humidity, windy conditions, cool temperatures, and absence of suitable overwintering plants. That is why England regards Scotland and Ireland as her main sources of seed potatoes. It also explains why seed potatoes grown in the western bush districts of Southland and the elevated foothills of Canterbury are generally freer from virus infection than are those grown in other localities.

In general, virus-infected plants produce more smaller tubers than do healthy plants. Where yields are high, most of the tubers from healthy plants are of table size and diseased plants produce more tubers of seed size; where yields are low, virus-infected plants produce fewer tubers of seed size and healthy plants produce more.

Thus in localities of low yield there is a natural elimination of tubers carrying virus diseases. The worst localities for seed production are those where yields are heavy and the climate and the surrounding crops favour the multiplication of aphides. Locality is an important factor influencing the spread in the field of viruses transmitted by aphides and also affecting the percentage of infected tubers retained for replanting.

Significance of Isolation

Isolation, or lack of it, is another important influence in the spread of all virus diseases, whether aphis transmitted or not.

As virus X is transmitted from plant to plant only by contact, obviously if individual plants are isolated beyond possibility of contact, this virus cannot spread in the field. Also, if all infected plants can be removed from a line, re-introduction of the disease can be prevented if no plants from an outside source come in contact with the healthy line.

EFFECT OF LOCALITY ON VIRUS INFECTION AND YIELD OF DAKOTA VARIETY

Locality	Incidence (%) of virus in central trial after growing in different localities for			Yield (tons) in central trial after growing in different localities for		
	1 year	2 years	3 years	1 year	2 years	3 years
Culverden*	69	97	†	7.1	1.8	†
Pleasant Point	44	61	69	9.9	3.2	5.8
Rangiora	28	27	31	10.4	5.3	12.5
Sheffield	20	13	†	11.1	6.1	†
Highbank	17	14	10	10.9	6.1	13.6
Winton	9	12	†	11.7	6.4	†
Tahakopa	9	13	9	10.6	6.3	14.5
Waipounamu	7	10	8	10.9	6.5	14.5
Tuatapere	7	8	9	12.2	6.2	15.6

* Reported to have been grown alongside Aucklander Short Top.
† Line not maintained for a third year.

The other viruses can be spread by aphides without physical contact between healthy and infected plants. Though in theory the exclusion of the aphis will prevent transmission of the disease, in practice this exclusion is much more difficult to maintain than is the degree of isolation necessary to prevent the spread of virus X. There certainly can be no complete isolation against spread within a crop, and the necessary distance between crops to prevent virus transmission by aphides varies with the conditions under which the crops are grown. Exactly what distance is required for satisfactory isolation cannot be stated. A dense, high hedge would give better protection than would a break of bare ground, and a strip sown to a crop such as wheat would contribute more to safety than would a strip of similar width in rape or kale. However, complete safety can be obtained only in the absence of aphides.

The varieties being grown have a bearing on what may be considered satisfactory isolation. Epicure and King Edward, for instance, are lethally necrotic to both viruses X and A and, because the viruses are killed at the points of entry, the plants are unable to transmit either, so they can be grown alongside varieties susceptible to these viruses with no possibility of a transference of infection. The greatest danger occurs when a variety carrying a virus without showing symptoms is grown close to one which is very susceptible to that virus, either alone or in combination with another virus carried perhaps with masked symptoms.

Danger from Aucklander Short Top

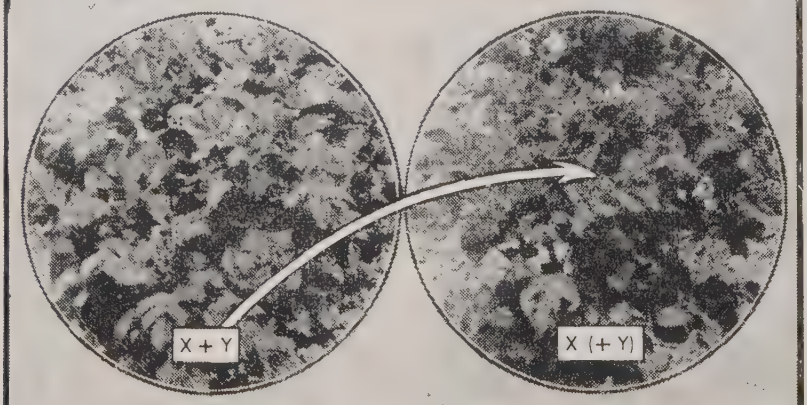
The significance of this is perhaps best demonstrated by a study of the varieties Aucklander Short Top* and Dakota, which are the two most widely grown varieties in New Zealand, but which are not grown commercially elsewhere. Aucklander Short Top rarely shows mosaic symptoms, but Dakota may show either very severe mosaic symptoms or the mildest symptoms, which become masked under certain growing conditions.

Recent investigations by the Plant Diseases Division of the Department of Scientific and Industrial Research have demonstrated that all plants of the Aucklander Short Top variety carry both mosaic viruses X and Y, apparently without symptoms—apparently, because to date no plant free from these two viruses has been found, so that an opportunity of comparing so-called healthy plants with really disease-free specimens has not yet arisen.

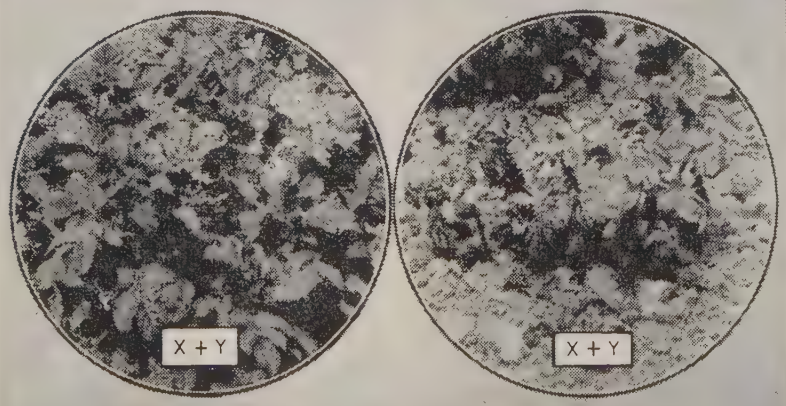
That Division has also recorded that all plants of Dakota tested carry the X virus. Many farmers have learnt from experience that the growing of these two varieties in adjacent blocks results in spectacular degeneration in the Dakota variety. In the light of present knowledge that can be explained by the effect on that variety, already carrying virus X, of an infection of virus Y from Aucklander Short Top.

* References to Aucklander Short Top apply equally to Aucklander Tall Top, a later-maturing "bolter" type which has arisen from Aucklander Short Top.

Apparently healthy crops of Aucklander Short Top (left) and Dakota (right), both of which carry virus diseases.



With crops grown in close proximity aphides carry the virus Y from Aucklander Short Top to Dakota.



The following season the Aucklander Short Top remains apparently healthy, but the Dakota is showing very severe mosaic symptoms.

This effect has been less noticeable in other varieties grown alongside Aucklander Short Top. There may be several reasons: These other varieties have been grown alongside Aucklander Short Top less frequently than has Dakota; stocks of the main varieties concerned are not infected by virus X to the same extent as is Dakota; and the symptoms of X and Y in combination may be more severe in Dakota than in other varieties.

Whatever the reason or reasons, Aucklander Short Top, popular as it may be, is plainly a menace to other varieties when grown without adequate isolation, particularly when the other variety is already appreciably infected by virus X.

Isolation Required for Certification

The Department of Agriculture has realised for some time that Aucklander Short Top is dangerous when grown alongside other varieties, and in the absence of more definite evidence has presumed that this was caused by the presence of virus X, which all stocks of this variety were known to carry. Mainly in an effort to combat this, an isolation of 5yds. between varieties was required before crops could be certified in the Mother class. This isolation should have been sufficient had virus X, a contact-transmitted virus, been the upsetting factor, but the latest research showing that virus Y is also carried by Aucklander Short Top explains the cases of degeneration sometimes recorded in the Dakota variety grown 5yds. away. It is the virus Y, transmitted by aphides across the break, which causes this marked degeneration.

As a result of this discovery the Department has already considered amending its isolation requirements for certification, but the problem is not an easy one to solve. A minimum isolation of perhaps 100yds. from Aucklander Short Top could be set for acceptance under certification of a crop of another variety, but what action should be taken where a shorter distance separates crops owned by different growers? Isolation of 100yds. may be quite inadequate in districts where the aphis population is heavy; its imposition may be unwarranted where the aphis population is negligible. Before planting, growers would require some indication of the minimum isolation necessary for certification. The Department's opinion, supported by the Seed Potato Certification Advisory Committee, is "that no change in isolation requirements should be made at the moment, but that growers should be warned of the danger in growing Aucklander Short Top in proximity to other varieties, and that later it may be possible to introduce amended isolation requirements which would reasonably meet all conditions."

The study of potato viruses has led to an understanding of degeneration and has given growers a practical approach to the problem of maintaining vigour in potato stocks. This problem is not made simpler by the presence of apparently healthy, though virus-infected, varieties. However, a knowledge of these varieties and the viruses they carry is the first step in combating their harmful effect on other varieties.

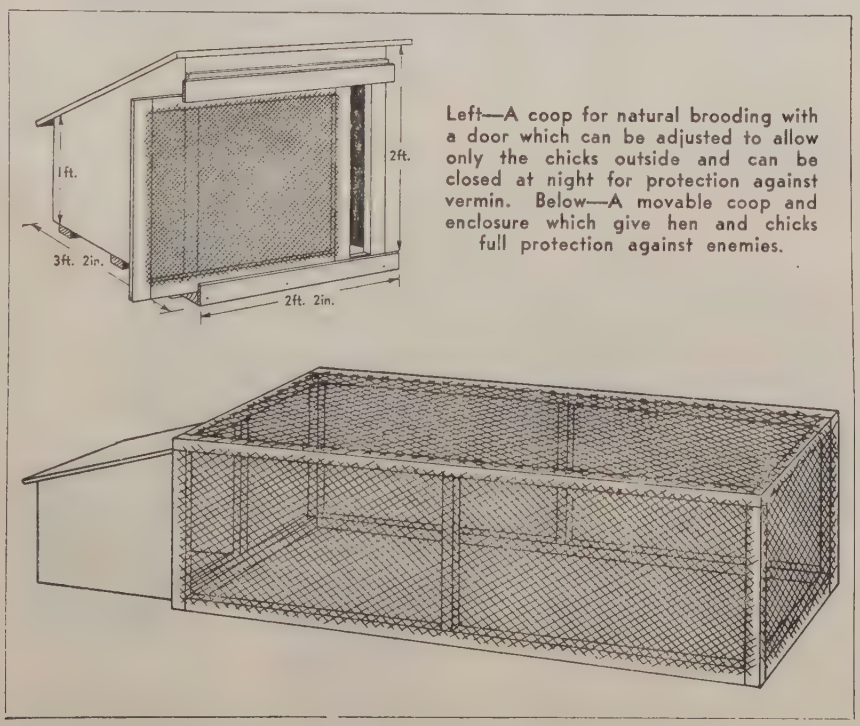
Chick-rearing Methods for Household Poultry Keepers

FIRST decision to be made by a household poultry keeper intending to buy replacement stock is whether to buy day-old chicks, perching pullets, or near-laying pullets. The work involved in rearing young chickens must be taken into account, because if it is not carried out well, the chicks are likely to be given a setback which will considerably affect future egg production, even if mortality is not increased. The second aspect for consideration is the method of rearing the chicks. In this month's article for the household poultry keeper W. L. McIver, Poultry Instructor, Department of Agriculture, Hamilton, contrasts the merits of natural and artificial rearing methods.

[*Fraser Niederer photo.*
A mother hen will usually hatch eggs and rear chicks efficiently.

ESPECIALLY in the treatment of livestock, the general view of the public is that natural methods are best. They argue that Nature must be right and that restrictions imposed under natural conditions are correct and even ideal. Anyone with only a small knowledge of poultry must have serious doubts about the accuracy of this view. The management methods of commercial poultry keepers are almost as far from Nature as they could be. They rarely use hens to hatch or rear chicks. Admittedly, they range the growing stock over as large an area of clean pasture as they can spare, and the wiser farmers ensure that adequate shade is available, but more often than not, particularly on the larger farms, when the pullets have reached maturity they are housed intensively, so that with the possible exception of the pens of breeding hens they never touch the ground again. This exception is made in favour of the breeders not merely because they are required to develop better health and stamina, but also because it is essential that hens coming through the moult have sufficient exercise to prevent their becoming too fat, thus causing delay in the return to egg laying, the production of misshapen eggs unsuitable for incubation, and a reduction of fertility. The commercial farmer supplies housing and diet better than can Nature.

Prejudice against artificial methods of brooding chicks should not be allowed to influence the choice of method. All the circumstances should be considered.



Left—A coop for natural brooding with a door which can be adjusted to allow only the chicks outside and can be closed at night for protection against vermin. Below—A movable coop and enclosure which give hen and chicks full protection against enemies.

Types of Brooders

As this article is intended for the householder who is normally interested in rearing only a dozen or two chicks, the types of electrically and kerosene-heated brooders used by commercial farms will not be discussed. Apart from natural brooding by a mother hen, artificial types suitable for small lots of chickens are the cold or fireless brooder, the heated brooder box, and the infra-red lamp.

The outstanding advantage of natural brooding is that the mother hen greatly reduces the work required of the owner. The two disadvantages are that any disease or parasite of the hen is very likely to be passed on to the chicks before they develop immunity, and that obtaining a broody hen when one is required is frequently difficult, especially early in spring, which is the best time for rearing chicks.

A cold or fireless brooder depends in principle on the chicks supplying the warmth and the brooder conserving it. Disadvantages are that ventilation must be reduced and the chickens tend to be of lower vitality. Ventilation, not accompanied by draughts, is very important, for birds can withstand cold better than too much heat, provided they have comfortable quarters to which they can return at will. If a fireless brooder is modified by the provision of moderate heat at least during the night, better ventilation can be provided.

The infra-red lamp, though able to supply heat for far more than a couple of dozen chicks, is probably the best brooder for the householder. It is not dear to buy, is reasonably cheap to operate and simple to work, and gives full visibility of the chicks.

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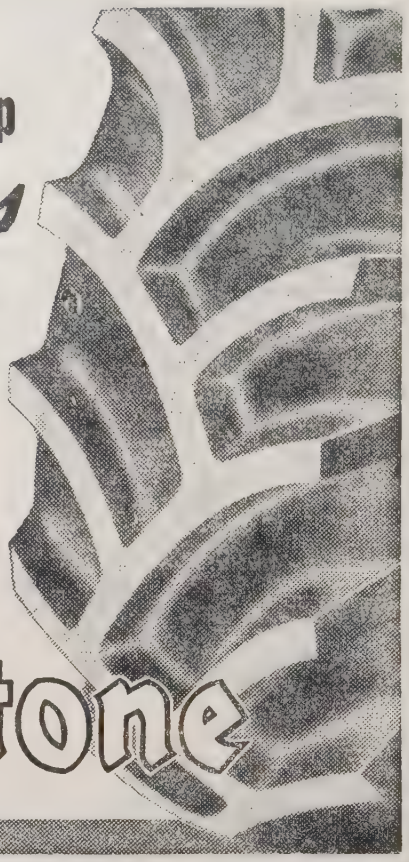

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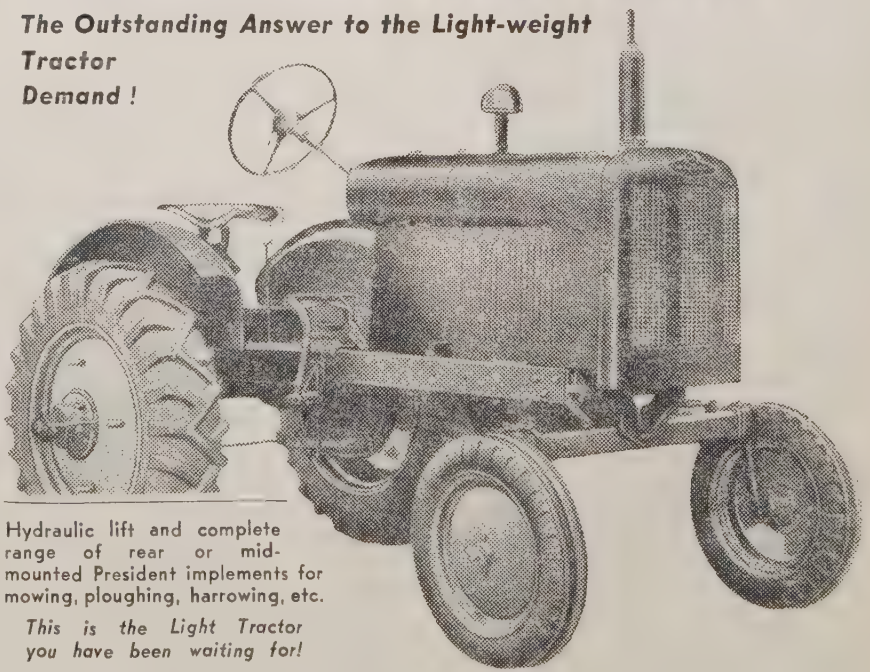

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Though some broody hens go off the brood in the middle of hatching, or through clumsiness trample on the chicks or wilfully kill some of them, usually a mother bird does an excellent job. Nevertheless, precautions must be taken against disease, parasites, weather, and enemies, for the hen has her limitations. She can call the chicks to food or back to warmth and shelter, warn about enemies, and give them a general education, but food, water, and shelter must be provided. Any home-made type of coop will suffice so long as it keeps out rain and wind while providing protection against enemies. The two illustrated on page 213 are good. One encloses both hen and chicks, so it is advisable to move it its full width daily on to fresh grass. The other is fully controllable: Hen and chicks can be shut in together at night or even during the day; both can be allowed out during the day, or the slide opened only enough to let out the chicks. For the first few days the mother hen is best confined, and after the first week it may be advisable to confine her until mid-morning, as her calls will then prevent the chicks from ranging far over wet grass. She will frequently call them back for warmth. Headroom in the coop must be adequate for the hen, because the danger of chicks being trampled on is increased if she is cramped.

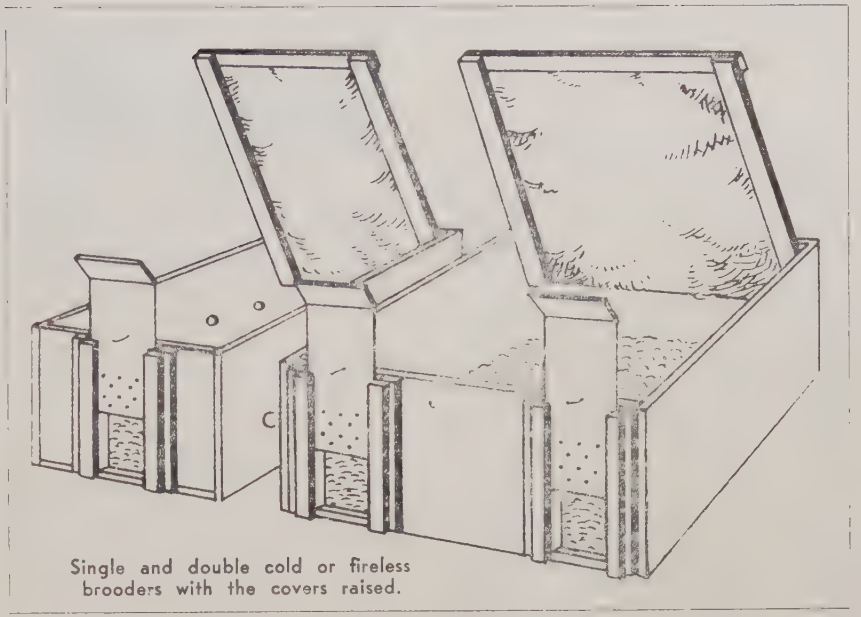
Because of the danger of disease being transmitted from hen to chicks, only a hen appearing in the best of health and condition should be used as a mother. Further, because all internal and external parasites of the hen are certain to be passed on to the chicks, she should be treated for them before being given the chicks.

Deworming of birds was described on page 577 of the "Journal" for December, 1949, treatment against lice on page 267 of the March, 1951, issue, and treatment against the mite which causes scaly-leg diseases on page 343 of the April, 1951, issue. Treatment for parasites of all types is covered in Bulletin No. 327, "Internal and External Parasites of Poultry", which is obtainable free from the nearest office of the Department of Agriculture.

When a broody hen has hatched out her eggs, the chicks should be allowed to gain in strength before being moved out of the hatching nest. For some time after being hatched chicks are weak on their legs and are better sitting quietly under the hen. Bought incubator chicks to be reared by a hen should not be given to the foster mother until they are 36 hours old. It is advisable to test the hen with a couple of chicks before entrusting them all to her care. Better still is to give them to her at night.

If proper care and attention to feeding and general management cannot be given artificially brooded chicks several times daily, a broody hen will rear better chicks.

A hen can usually brood a much larger number of chicks than she can hatch. If the weather is favourable, a foster mother may be given 18 to 24 chicks.



Single and double cold or fireless brooders with the covers raised.

Experiments have shown that chicks suffer no harmful effects if fed as soon as they are fluffed up after being hatched, but they have also shown that no advantage is gained by feeding them before they are 48 hours old. Feeding and management of chicks are described in Bulletin No. 199, "Chick Raising", obtainable from any major office of the Department of Agriculture for 6d., post free.

Cold or Fireless Brooders

The illustration on this page shows the general principle of a cold brooder, which can be made easily from many different materials. Essentially it is a device to confine the chicks and conserve their natural body heat.

Its most serious disadvantage is the difficulty of training the chicks to return to the unheated cover for warmth after feeding. If a few chicks huddle in a corner, the rest will join them instead of going inside the brooder.

Heated Brooders

Electricity provides a simple way of supplying heat to a brooder. A low-powered electric lamp can be used, the wattage required depending on the size, height, and ventilation of the brooder. About 40 watts is sufficient, but it is easy to experiment until the lamp supplying the correct amount of heat is found. The way in which the chicks chirp indicates whether they are contented, and the difference in tone between happy and discontented chirping is obvious.

Fear of chilling the chicks often results in their being kept dangerously warm. After the first few days continuous high temperatures sap their vitality. Cool, fresh air is invigorating and healthful, and the chicks enjoy it provided they can return to the warmth at will. The lamp should be high enough above the chicks' heads to prevent their becoming overheated, with provision for the lamp to be lowered a little at night.

Warmth may be supplied in a small brooder by a hot-water bottle or heated bricks, but there must be enough floor litter or other covering, such as blanket or flannel, to prevent discomfort or even burns to chicks pressed by weight of numbers against the bottle or bricks.

Chicks can be reared in shoe boxes with ventilation holes or in the chick boxes in which they arrive. They can develop normally under quite close confinement, but the muscles and digestive organs need exercising. A range of temperatures and roomy, well-ventilated quarters are incentives to exercise. Chicks brooded in a confined box at night should be released into adequate space early each morning, preferably on to a floor well covered with good litter, where they will enjoy working for their food. The warming cupboard of a hot-water cylinder makes excellent night quarters, and a barricaded position near the stove or fireplace provides good daytime quarters if the housewife is willing to put up with some inconvenience.

The chicks benefit from direct sunlight after about 5 days, but they must be guarded against draughts, and they need shade and a sheltered place to which to go when they wish.

Infra-red Brooding Lamps

A fairly new method of brooding chicks, about which the small-scale chick rearer is not likely to know much, but the advantages of which he could well learn, is by the use of an infra-red lamp, as shown in the illustration on the next page. This method is economical and highly satisfactory, especially for small numbers of chicks. The lamp requires the minimum of attention, but the chicks still need the care and management necessary with any type of artificial rearing. Handling of the chicks is very simple, as they are not hidden by any cover. The floor litter keeps drier, reducing the likelihood of the spread of disease. Health and growth are improved by the constant light.

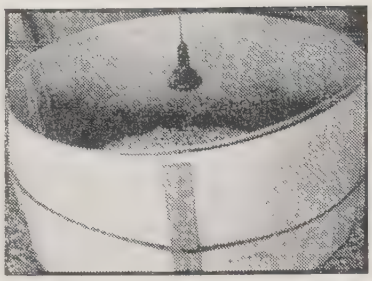
216—REARING CHICKS BY INFRA-RED LAMP . . .

Control of the lamp is important. The 250-watt infra-red lamp is suspended so that the base is 17in. from the floor, without counting the litter depth. A guard circle about 6ft. in diameter and 1ft. high prevents floor draughts and stops the chicks from straying; a higher guard would be necessary in a draughty room. After 3 or 4 days the circle can be dispensed with during the day, but for about another week its use may be advisable at night.

For the first week the lamp is needed day and night. During the second week it should be raised a couple of inches during the day, but lowered again at night. In the third week the lamp may be turned off for portions of the day according to the weather, and be raised 2 to 4in. at night.

The chicks are likely to experience panic if the light fails suddenly, so with larger hatches of chicks provision of a small independent pilot light may be advisable. In view of the very quick loss of heat if the power supply fails, a valuable precaution during the first fortnight is to have an alternative source such as a hover or a kerosene heater.

The chicks must be fed on a good, balanced mash to maintain their growth rate. Plenty of greenfeed should be supplied, and the addition of a fish-liver oil to the diet is highly desirable for its vitamin A and D values. Food and water must be available at all times within the lighted area or toe picking is likely to develop into a vice.



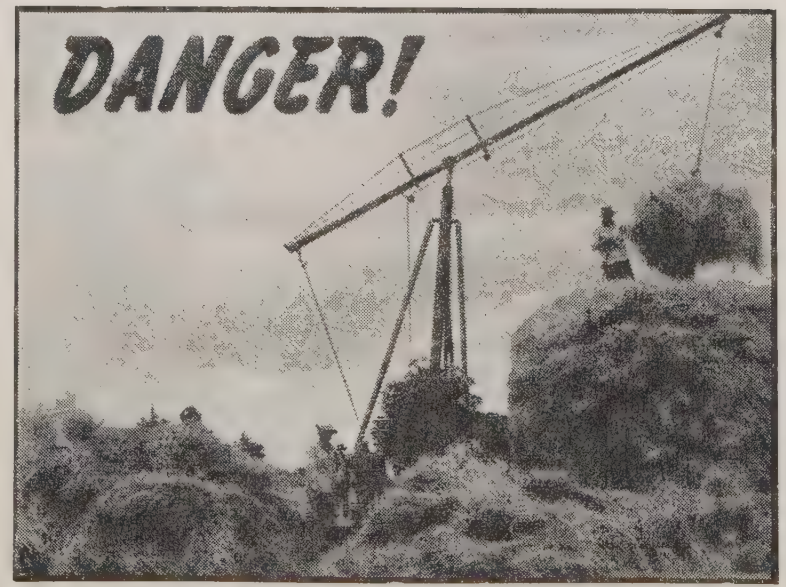
[*Fraser Niederer photo.*

An infra-red lamp can be used to rear batches of up to 70 chicks. For the first few days they should be restrained in a barrier, which can be enlarged gradually until it is no longer required.

The bright light day and night may be thought to make sleep difficult for the chicks, but their habits are considerably different from those of chicks under what might be regarded as more natural conditions. The chicks are active during parts of the night and rest more during the day. When sleeping during the day they may appear to be dead at first sight, so restful and relaxed is the pose they adopt.

The householder who wants to rear between 12 and 70 chicks and has suitable accommodation for them during the rearing period should seriously consider adopting the infra-red lamp type of brooder.

Though all heavy-breed hens are subject to broodiness, many strains have been bred by farmers to be what is called "broody-reduced". As a result, the hens often do not go broody early in spring. Householders who want to rear a few chicks tend to wait until a hen does go broody and then to buy the chicks or hatching eggs late in the season—sometimes in November or even December. That is rather late to expect to be able to rear good pullets, and such birds will not begin laying until May or June, whereas a pullet that will begin laying in March is the aim. Artificial brooding offers the outstanding advantage of being always available, even if it entails a little more work in general management.



MOST accidents which occur with stackers can be traced to worn or faulty equipment, overloading, or lack of care when fixing anchor pegs or guy ropes. Especially where a tractor is used instead of a horse to raise the load, the power available may lead to workers being tempted to lift more than either the stacker or its means of anchoring was designed for.

Lack of care when working with a stacker can lead to serious and often fatal accidents, so users of such equipment should check its condition before using it, examine anchor pegs and guy ropes frequently while they are in use, and refrain from overloading the grab.

—D. F. SCOTT, Farm Machinery Instructor,
Department of Agriculture, Auckland

Show Dates

THE following are dates and venues of A. and P. shows up to early December.

October 13—Ellesmere A. and P. at Leeston.

October 17 and 18—Hawkes Bay A. and P. (spring show) at Hastings.

October 20—Northern A. and P. at Rangiora.

October 25, 26, and 27—Waikato A. and P. at Hamilton.

October 26 and 27—Marlborough A. and P. at Blenheim.

October 26 and 27—Poverty Bay A. and P. at Gisborne.

October 26 and 27—Wairarapa and East Coast A. and P. at Carterton.

October 27—Amberley A. and P. at Amberley.

October 27—Timaru A. and P. at Timaru.

November 1—Ashburton A. and P. at Ashburton.

November 2 and 3—Manawatu and West Coast A. and P. at Palmerston North.

November 7, 8, and 9—Canterbury A. and P. at Christchurch.

November 9 and 10—Wanganui A. and P. at Wanganui.

November 9 and 10—Whangarei A. and P. at Whangarei.

November 14—North Otago A. and P. at Oamaru.

November 14—Thames Valley A. P. and H. at Te Aroha.

November 16 and 17—Egmont A. and P. at Hawera.

November 16 and 17—Nelson A. and P. at Nelson.

November 17—Bay of Islands P. and I. at Waimate North.

November 17—Taieri Agricultural Society at Outram.

November 17—Courtenay A. and P. at Kirwee.

November 17—Waimate A. and P. at Waimate.

November 20 and 21—Otago A. and P. at Dunedin.

November 22, 23, and 24—Auckland Metropolitan A. and P. (Royal Show) at Auckland.

November 23 and 24—Stratford A. and P. at Stratford.

November 24—Motueka A. and P. at Motueka.

November 24—West Otago A. and P. at Kelso.

December 1—Helensville A. and P. at Helensville.

December 1—Tokomairiro A. and P. at Milton.

December 1—Winton A. and P. at Winton.

December 4 and 5—Gore A. and P. at Gore.

December 8—Kaikohe A. P. and H. at Kaikohe.

December 8—Wyndham A. and P. at Wyndham.

Fineness of Grinding of Agricultural Limestones

By E. B. DAVIES, Senior Chemist, Department of Agriculture Soil Research Station, Rukuhia

THE qualities of an agricultural limestone which immediately affect the farmer are its purity and its fineness. The purity is of obvious importance and off-hand would be considered the first essential. Reasonably fine crushing is, however, equally important. Uncrushed limestone rock would be as useless for liming purposes as a powder containing no carbonate of lime. Just as agricultural limestones are sold which contain 40 to 50 per cent. impurity, so also are sold products which through poor grinding are less than 50 per cent. effective. The purity of limestone in any district is to a great extent determined by what outcrops are available. Fineness of grinding on the other hand can be regulated, and if a finer product confers a real advantage, the farmer is perfectly justified in demanding it. This article discusses various effects of particle size on the action of limestone, surveys the crushed limestones at present on the market with respect to fineness of grinding, and presents the results of experimental work carried out over the past few years.

IT is necessary to have some yardstick to measure fineness of grinding. The terms coarse and fine are relative only, and what one man would describe as "coarse" might be "fine" to another. The yardstick used in the Department's laboratory is a nest of 5 British standard sieves, 8-mesh, 16-mesh, 30-mesh, 60-mesh, and 120-mesh. To test a limestone a weighed sample is passed through the series of sieves by a standard procedure and the percentages retained at each step and the percentages passing the finest sieve are determined. Six fractions are thus differentiated.

The mesh designation indicates the number of mesh to the inch. The size of hole is determined not only by the number of mesh, but also by the gauge of wire used—hence the need for standard sieves. The mesh dimensions in ten thousandths of an inch are given in Table I.

The coarsest sieve, with 8 mesh per linear inch, has an aperture $\frac{810}{10,000}$in. square, that is, a little under $\frac{1}{10}$in. across; the next sieve has an aperture of approximately half that dimension; the following sieve, half that again, and so on.

All agricultural limestones in New Zealand are sampled periodically and subjected to this sieve analysis as well as being tested for purity.

Effects of Particle Size

Number of particles: It has been pointed out that the mesh size of the sieves is halved at each step. It follows that in each successive fraction from 8- to 16-mesh to 60- to 120-mesh separated in the sieve analysis the mean edge of particle is halved. (For purposes of discussion the particles will be considered as cubes.) The fine material passing the 120-mesh sieve will be considered, as an approximation, as four times as fine as the 60- to 120-mesh fraction.

When a cube is cut up so that the edge is halved, 8 smaller cubes result. This may be easily demonstrated with children's blocks; if 8 of them are assembled as a cube the length of edge is twice that of edge of 1 block. In Table 1 the number of particles of each size corresponding to one 8-16 mesh fragment is given. It will be realised that because of the enormously greater number of particles in the finest material such material gives much better coverage of the ground, a point made very clear in Fig. 2.

Solubility: A particle of limestone dissolves from its exposed surface. The finer a limestone is crushed, the more surface area is exposed and the more rapidly it dissolves and becomes effective. As it passes down the fineness scale the surface area of a given weight is doubled at each step. Children's blocks again can demonstrate the point. Eight blocks have 48 faces; placed together in a single cube 8 blocks have 24 faces exposed. Material of 60- to 120-mesh size has eight times the surface area of the same weight of 8- to 16-mesh lime and dissolves eight times as fast. Relative surface areas are given in Table 1.

Penetration: Fine particles work down into the soil, where the soil solution can exert its solvent power. Coarser fragments tend to remain on the surface, dry and unattacked.

TABLE 1—DIMENSIONS OF SIEVES

Sieve	Width of aperture (1/10,000in.)	Fractions separated in sieve analysis	Relative numbers of particles in a given weight	Relative surface area of a given weight
8-mesh	810	Retained 8-mesh	—	—
16-mesh	395	Passed 8-mesh, retained 16-mesh ..	1	1
30-mesh	197	Passed 16-mesh, retained 30-mesh	8	2
60-mesh	99	Passed 30-mesh, retained 60-mesh	64	4
120-mesh	49	Passed 60-mesh, retained 120-mesh	512	8
		Passed 120-mesh	32,768*	32

* It has been taken as an approximation that the fine material passing the 120-mesh sieve has a mean particle diameter one quarter of that in the 60- to 120-mesh fraction.

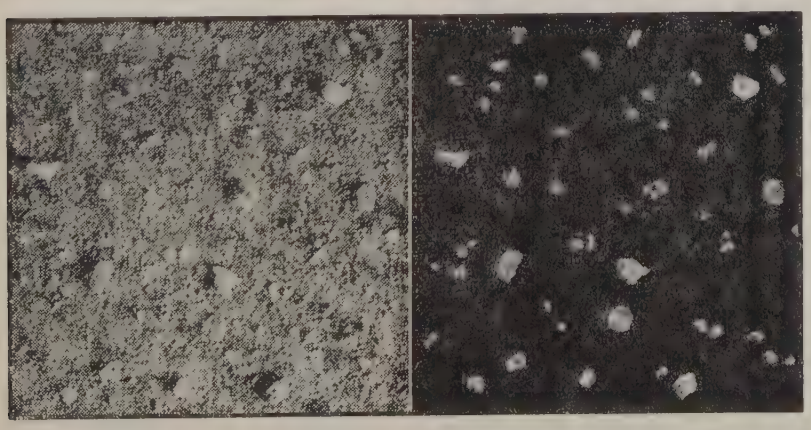


Fig. 1—Coverage of 1 ton per acre of a poorly crushed limestone when applied (left) and when the fine material has dissolved (right). The bulk of the carbonate of lime lies in the coarse material ineffective through slow solubility and poor coverage. (Particles almost actual size.)

Classification of Fineness of Grinding

Purity of a limestone can be expressed by a single figure, but fineness of grinding is indicated by a sieve analysis involving six figures, and it becomes difficult to compare a number of products. From experimental work over the past 3 years (to be reviewed later in this article) it has become plain that with normal limestones the portion coarser than 16-mesh (or even 30-mesh) has very little effect at ordinary rates of application. On the other hand particles finer than 60-mesh would probably have their full effect in the course of a year. Accordingly, possible sieve analyses have been divided into 5 groups, with the descriptive names very coarse, coarse, medium, fine, and superfine, according to the percentages coarser than 16-mesh and finer than 60-mesh. The 5 groups are defined as follows:—

Description	Percentage retained on 16-mesh sieve	Percentage passing 60-mesh sieve
Very coarse ..	—	Less than 25
Coarse ..	Less than 45	25 to 35
Medium	Less than 35	35 to 50
Fine	Less than 25	50 to 70
Superfine ..	Less than 10	Over 70

On this basis all New Zealand agricultural limestones which have been sampled since 1950 have been classified, the latest analysis being used in each case. The number falling in each category is recorded, district by district, in Table 2. Fig. 3 shows the distribution diagrammatically, each limestone being plotted according to the percentages coarser than 16-mesh, 16- to 60-mesh, and finer than 60-mesh.

TABLE 2—CLASSIFICATION OF LIMESTONES

	Very coarse	Coarse	Medium	Fine	Superfine
Auckland	—	1	21	17	1
Wellington	3	4	2	—	—
Canterbury, Marlborough, Nelson, and West Coast (S.I.)	—	6	20	7	4
Otago and Southland	—	9	6	2	1
Total	3	20	49	26	6

On a basis of experimental results it is considered that with few exceptions agricultural limestones should qualify for a "fine" grading in order to be reasonably efficient. That the Department of Agriculture accepts a lower standard (that 50 per cent. pass the 30-mesh sieve and none be retained on the 8-mesh) as the minimum to qualify for lime-transport assistance does not necessarily imply that such standard is regarded as fully satisfactory.

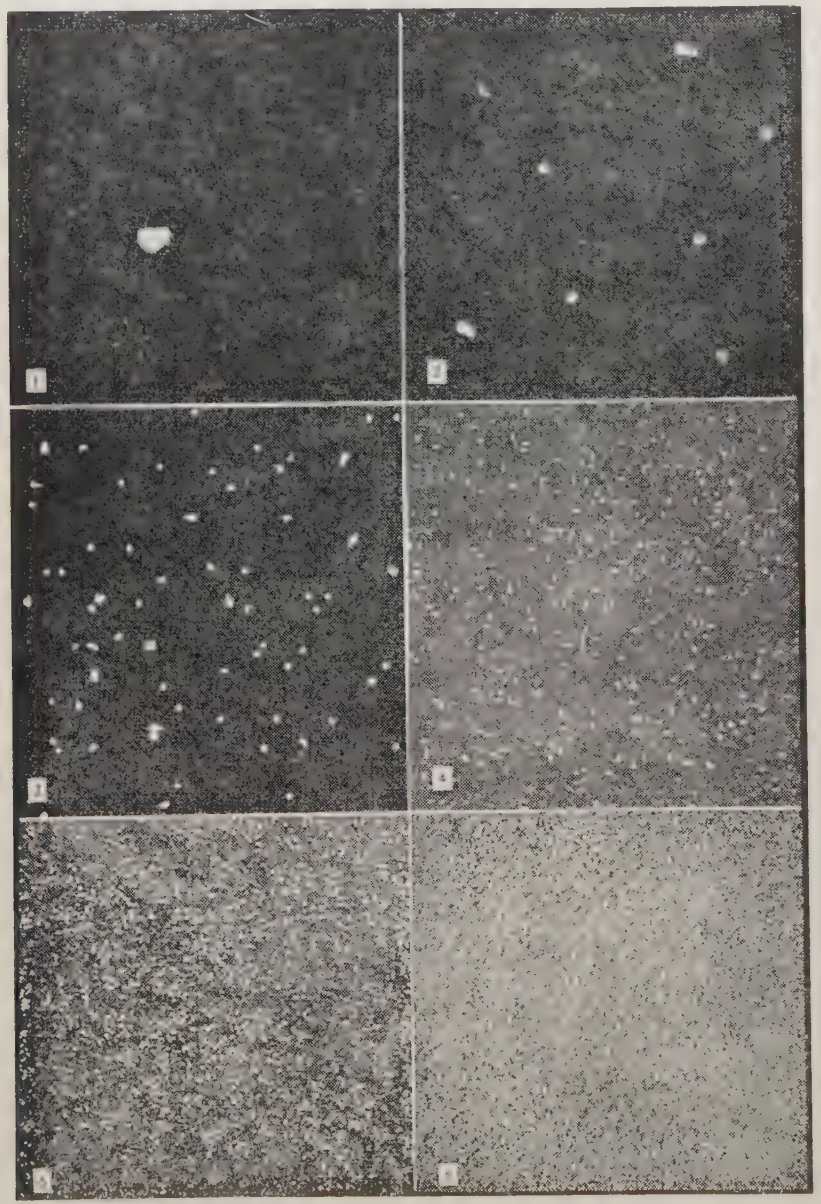


Fig. 2—Coverage of crushed limestone applied at 1cwt. per acre. 1: Retained 8-mesh sieve. 2: Passed 8-mesh, retained 16-mesh. 3: Passed 16-mesh, retained 30-mesh. 4: Passed 30-mesh, retained 60-mesh. 5: Passed 60-mesh, retained 120-mesh. 6: Passed 120-mesh. (Particles almost actual size.)

Carbonate of Lime Content of Size Fractions

In a high-grade limestone containing over 90 per cent. carbonate of lime there is usually little difference in the purity of the various fractions separately in a sieve analysis. With lower grades it frequently happens that the impurities, being softer than limestone, crush more readily and become concentrated in the fines. With shell limes the main impurity is sand, which largely falls in the 60- to 120-mesh fraction. The impression of adequate fineness conveyed by a sieve analysis may in such cases be misleading. The following shell lime analysis demonstrates the point:—

Fraction	Percentage of product	Purity of fraction Per cent.	Carbonate of lime in fraction
Retained 8-mesh	0.2	not determined	0.2
8- to 16-mesh	14.0	95.5	13.4
16- to 30-mesh	18.0	95.0	17.1
30- to 60-mesh	17.2	85.4	14.7
60- to 120-mesh	29.4	43.0	12.6
Passed 120-mesh	21.2	84.0	17.8
	100.0		75.8

The sieve analysis shows 50.6 per cent. passing the 60-mesh sieve, placing the lime in the "fine" category. The lime in this "fine" material, however, represents only 30.4 per cent. of the sample.

A simple guide to the usefulness of agricultural limestones would be provided in a report of three figures: The percentage of carbonate of lime retained on the 16-mesh sieve, the percentage passing the 16-mesh but retained on the 60-mesh, and that passing the 60-mesh—in the above case 13.6, 31.8, and 30.4 respectively. The 13.6 per cent. would be largely ineffective, the 31.8 per cent. slowly effective, and the 30.4 per cent. of immediate benefit. The balance (24.2 per cent.) is impurities.

From such figures the comparative value of limestones could be readily assessed.

Reactivity

It is often claimed in defence of a coarse product that it is particularly easily dissolved and does not need fine grinding. All New Zealand limestones have been examined by a laboratory method for "reactivity" and it has been found that some do dissolve much more rapidly than others. The "reactivity" is an inherent characteristic of the stone distinct from any effects due to fineness of grinding. It is broadly correlated with hardness, that is, the harder the limestone the slower it is to dissolve. A "reactivity index" has been applied, the index being proportional to the rate of solution of the limestone in a dilute acid, that is, the higher the number, the more reactive the stone. A 1948 survey gave the results shown in Table 3 on the opposite page.

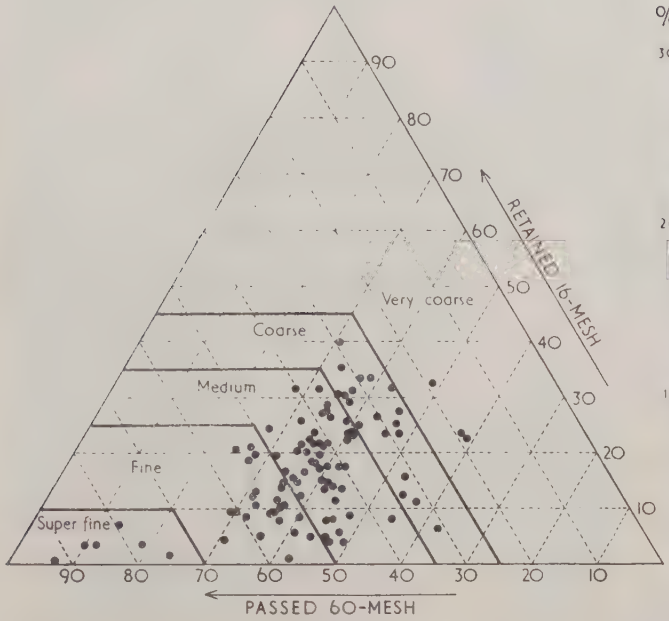
No North Island stone is particularly soluble. Of the 49 limestones graded as "medium" in fineness of grinding, 4 have a reactivity index between 40 and 50 and 1 over 50. These would perhaps be reasonably effective without finer grinding.

EXPERIMENTAL WORK

Experiment 1

For critical growth experiments designed to test the value of either limestones or fertilisers it is desirable:—

1. That a soil markedly deficient in the element concerned be used.
2. That the application be well below that required for optimum growth conditions.



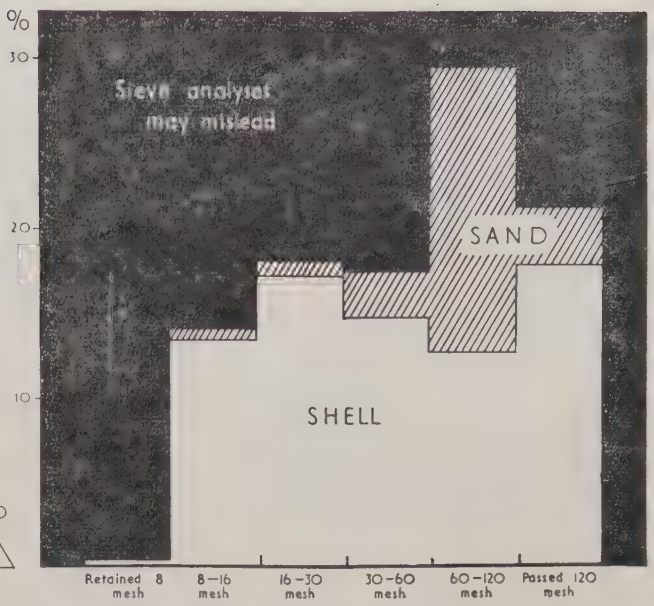


Fig. 3 (left)—Fineness of grinding of New Zealand agricultural limestones. Limestones are here plotted according to the percentages retained on 16-mesh and passing 60-mesh British standard sieves. Fig. 4 (right)—Distribution of sand in a shell limestone.

TABLE 3—DISTRIBUTION OF REACTIVITY INDEXES

	20 and under	21-30	31-40	41-50	51-60	Over 60	Total
North Island ..	—	40	14	—	—	—	54
South Island ..	4	16	12	16	5	3	56
Total	4	56	26	16	5	3	110

The very sensitive portion on the lower range of the growth curve will then be concerned and marked differences between treatments expected. Accordingly, in the first experiment of this series an extremely acid soil (pH 4.6) was selected and lime treatments about 40 per cent. of the theoretical requirement applied. A comparison was made between a hard, slowly soluble limestone and a soft stone. The latter dissolved some four times as rapidly as the former in a laboratory test. Two finenesses of grinding were employed: Material passing a 1-mm. round-hole sieve but retained on a 30-mesh sieve, and 60- to 90-mesh material.

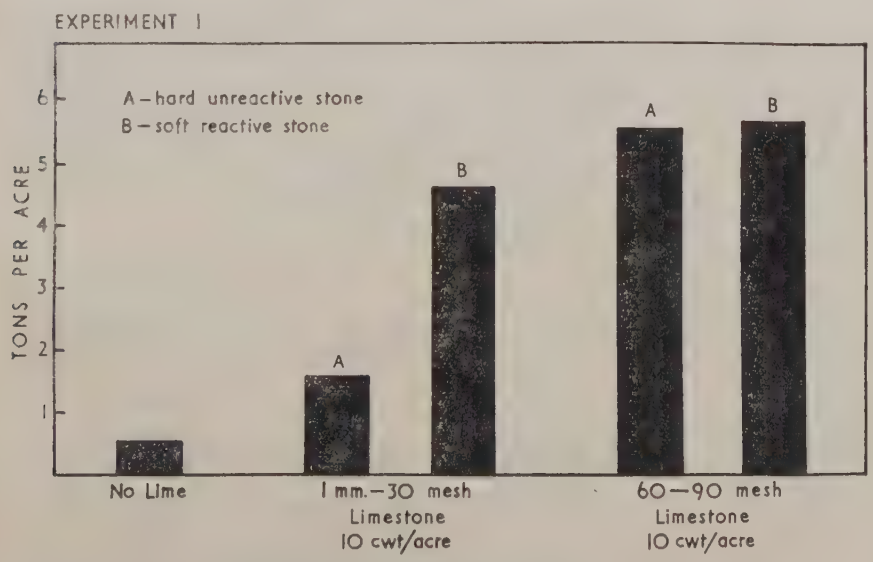


Fig. 5—Response of subterranean clover to limestone on an acid soil. Effect of fineness of grinding and type of limestone.

The two grades represent neither especially coarse nor especially fine fractions, but tend toward the extremes of the medium range. They may be roughly likened in texture to ordinary table sugar and a fine table salt respectively. Four replicates of each treatment were run. Yield results are presented graphically in Fig. 5. (See also Fig. 6.)

The finer fractions of both limestones proved equally effective, producing responses amounting to over 800 per cent. The coarser treatments differentiated the two stones, the less reactive one being less efficient, while the more reactive almost equalled the finer treatments. It should be pointed out that the two types of limestone were at the extreme range of reactivities. 17 and 67 on the scale employed. From the fact that the average of all limestones tested was 29, and also from the distribution of indexes shown earlier, it can be seen that the stone of index 67 was unusual and its ability to produce a notable response at the coarser grinding not applicable to the normal run of limestones. The hard stone was much nearer the average.

Experiment 2

Since the preliminary experiment showed such marked effects of both fineness and reactivity, it was followed by a second, more detailed experiment.

Slowly and highly reactive stones, having indexes of 17 and 57 respectively, were compared at two finenesses as before, but also at two rates. A third grade of calcium carbonate, extremely fine precipitated chalk, was included. The comparisons are summarised below:—

Limestones: Reactivity indexes 17 and 57.

Finenesses of grinding: 1. Passed 1 mm. round-hole sieve, retained 30-mesh sieve. 2. Passed 60-mesh sieve, retained 90-mesh sieve. 3. Extremely fine calcium carbonate.

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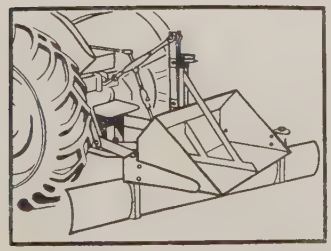

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There were 5 replicates of each treatment.

Two successive crops of subterranean clover were grown. The first (Tallarook) was higher yielding than the second (Mt. Barker), which moreover was cut at an earlier stage. Results are presented in Fig. 7 and some comparisons shown in Fig. 8.

The following points are noteworthy:—

First Crop

1. **Slowly reactive stone:** The finer ground stone gave about three times the increase in yield obtained from the coarser treatments. Doubling the application did not significantly increase the yield.

2. **Highly reactive stone:** Again, the finer grinding was much more effective. Doubling the application, however, made a considerable difference, particularly in the coarse treatment. The effect from 1 ton of the coarse material did not differ significantly from that from 10cwt. of the finer.

3. **Precipitated chalk:** This extremely fine material had no apparent advantage over 60- to 90-mesh material. One ton and 10cwt. applications gave the same yield.

Second Crop

The crop which did not receive lime was a failure. Of the lime treatments, in contrast with the first crop, the higher rate gave markedly better results. The explanation is not the obvious one of exhausted lime supply, as even the best of the first yields removed an amount of lime equivalent to less than a quarter of the application, and controlled watering eliminated drainage losses. The low application of the coarse, slowly soluble lime A, rather than increasing in effect with time, failed to produce a crop.

Another point of contrast with the first crop is that here the ton applications of coarse lime were more effective than the 10cwt. applications of the finer material. The effect of nature of limestone is very well shown, the reactive stone B proving superior to A except in the higher application of 60- to 90-mesh material. The extremely fine lime was not as effective as some of the other treatments. Albrecht (1) has pointed out that it is an advantage for the acidity of a soil not to be too uniform. It is best to have a mixture of more- and less-acid spots, some favouring the uptake of one nutrient, some another. Possibly the very fine carbonate of lime produced an undesirable uniformity.

Experiment 3

The first two experiments demonstrated a superiority of highly reactive limestones over less reactive, particularly at the coarser grinding, and of 60- to 90-mesh over 1 mm. to 30-mesh material, particularly in slowly soluble stones.

In experiment 3 an average limestone (reactivity index 29) was selected and the various sieve fractions from 8-mesh down were compared.

(1) Soil Science 61, 1946 (265-271).

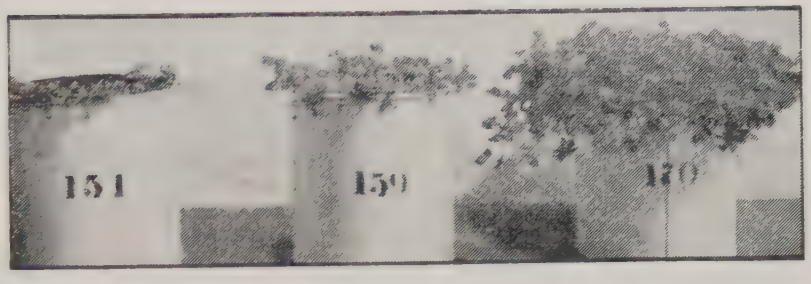

Fig. 6—Response of subterranean clover to a hard limestone (A, Experiment 1). 151: No lime. 159: 1 mm. to 30-mesh. 170: 60- to 90-mesh.

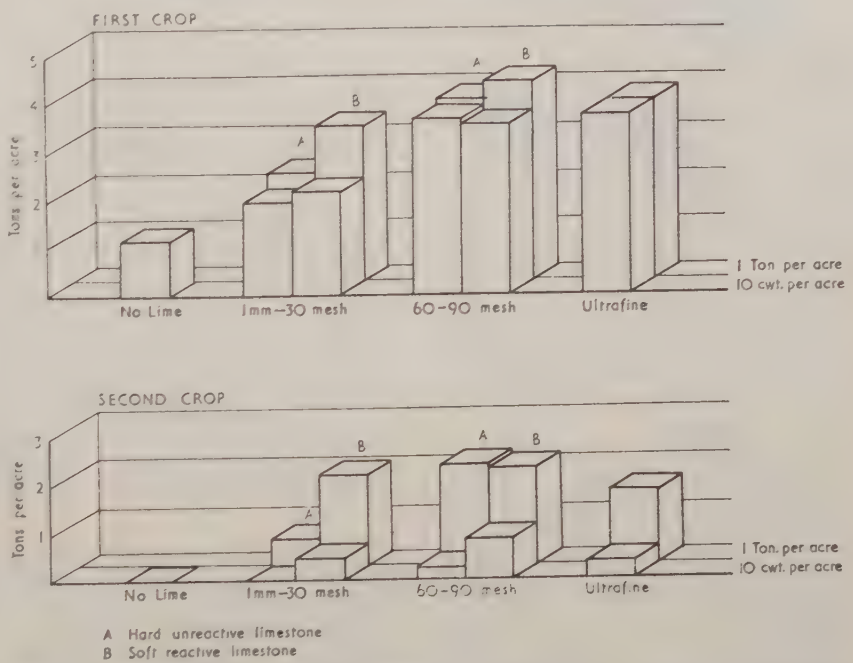

Fig. 7—Response of successive crops of subterranean clover to limestone (Experiment 2). Effect of fineness of grinding, type of stone, and size of application.

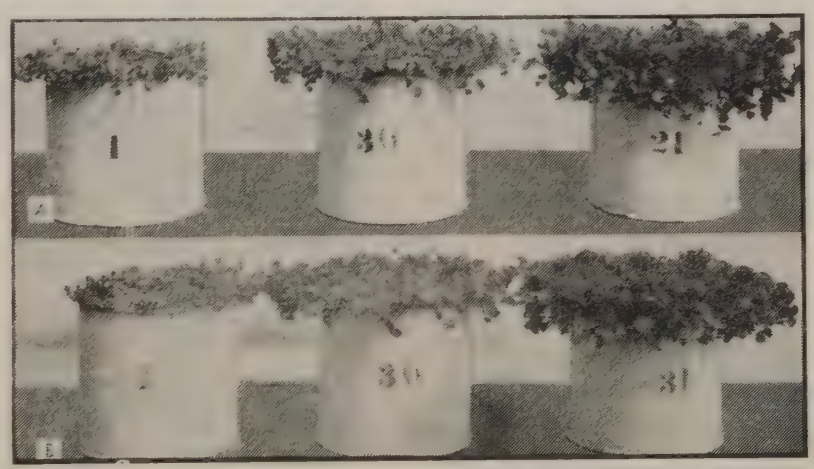

Fig. 8—A: Response of subterranean clover to a hard limestone (A, Experiment 2). 1: No lime. 36: 1 ton 1 mm. to 30-mesh. 21: 10cwt. 60- to 90-mesh. B: Effect of type of limestone on response (Experiment 2). 1: No lime. 36: 1 ton of hard limestone 1 mm. to 30-mesh. 31: 1 ton of soft limestone 1 mm. to 30-mesh.

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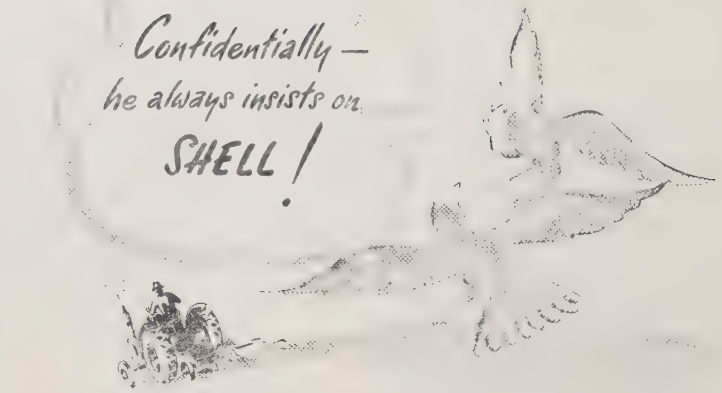

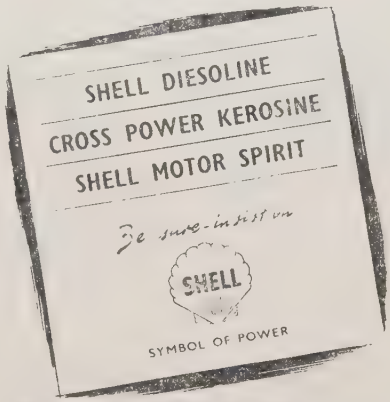

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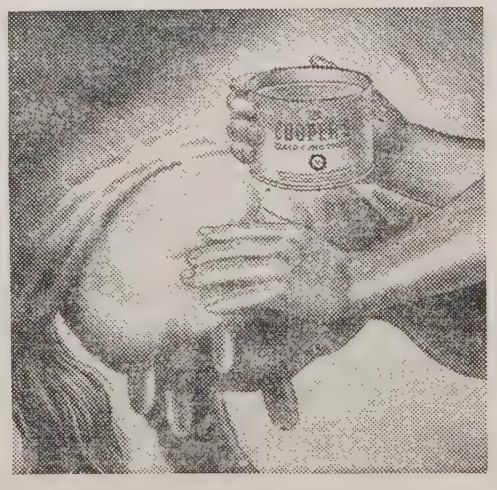

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Fig. 9—Effect of fineness of grinding on subterranean clover response to limestone (Experiment 3, second crop). Treatments, reading from left to right are: No lime, 8- to 16-mesh, 16- to 30-mesh, 30- to 60-mesh, 60- to 120-mesh, passed 120-mesh. Rate of application was 39cwt. of carbonate of lime per acre.

Lime may cause increased growth for a number of reasons, and the critical factor is likely to vary from soil to soil. In the second experiment yield was closely related to uptake of lime, suggesting that lime supply might be the limiting factor. Against this, the clover even in the low yields had quite a fair lime content. Moreover, the clover in the low-yield pots contained an abnormally high percentage of manganese in contrast to a very low content in the better treatments. Manganese toxicity may well have been the prime limiting factor.

In experiment 3 the effect of fineness was checked on soil of a different type—less acid and low in exchangeable manganese. Any lime response would be from some reason other than reduction of active manganese. Lime was applied at the rate indicated from results of soil analysis—almost 2 tons per acre. Again treatments were in quintuplicate. Yields are presented diagrammatically in Fig. 10. Fig. 9 shows the second crop. In the first crop lime was not really effective till finer than 60-mesh; in the second the 30- to 60-mesh material produced reasonable growth. In the second crop growth almost failed with lime treatments coarser than 30-mesh.

Examination of the soil following the first crop (208 days from beginning of trial) and the second crop (114 days later) showed very little change in the residual limestone over the latter 114 days, and dissolving action appeared to have slowed up.

The residual limestone at the end of the experiment in each treatment, in terms of the initial application, was as follows (average of 5 pots):—

Treatment	Percentage of initial dressing undissolved	pH of soil
Control	—	4.8
8- to 16-mesh	80	5.1
16- to 30-mesh	63	5.4
30- to 60-mesh	17	6.0
60- to 120-mesh	Nil	6.0
Finer than 120-mesh	Nil	6.0

These pot experiments show clearly the necessity (from the short-term point of view at any rate) for reasonably fine grinding if a limestone is to achieve its purpose.

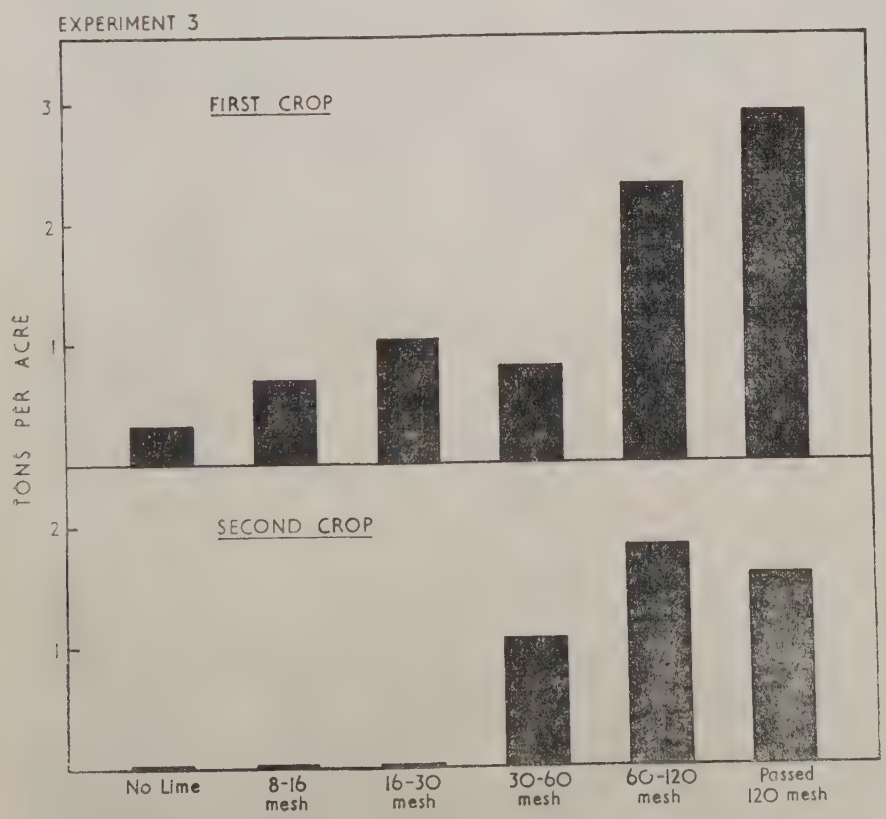

Fig. 10—Effect of fineness of grinding of an average limestone on subterranean clover growth (Experiment 3).

Field Experiments Laid Down

The pot experiment is most valuable for a first investigation, for experimental conditions are all under control. The field experiment, despite the fact that uneven fertility over the area concerned, droughts, irregularities in slope, etc., can combine to bias results, is nevertheless essential to reflect farming conditions. In the field limestone is applied to the surface, not incorporated in the soil as was the case in the pot experiments, and may be unaffected by the dissolving action of the soil solution. On the other hand, given sufficient moisture, carbonic acid from decaying plant and animal residues might speed the dissolving process.

Field experiments have therefore been laid down and results will be reported in a later article.

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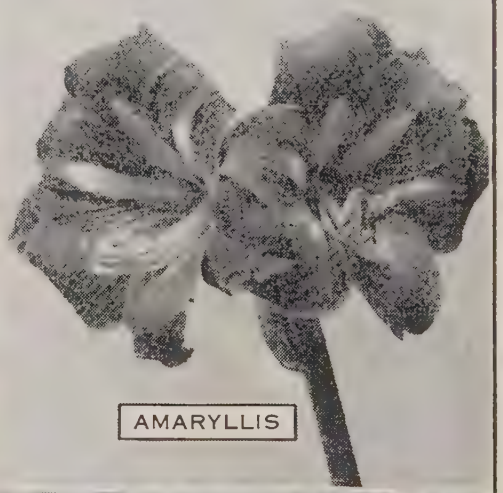
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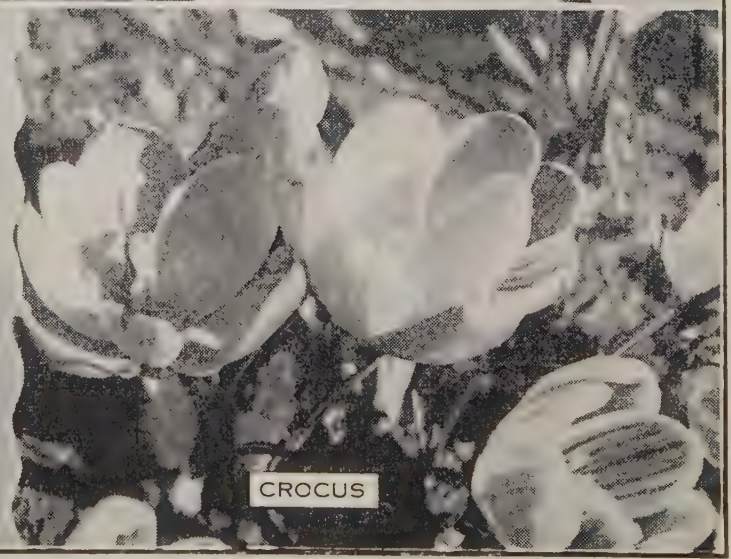
CROCUS

All photographs except bottom left by Douglas Elliott.

Bulbous Flowering Plants for the Cool Greenhouse

SOME of the better types of flowering plant which can be grown by the amateur gardener in a cool greenhouse unit were discussed in last month's article for the flower gardener by C. K. Ellis, Horticulturist, Department of Agriculture, Dunedin. This article deals with a few of the more easily cultivated bulbous plants suitable for greenhouse culture.

MOST bulbs are excellent greenhouse subjects because they require fairly cool conditions and very little room, and heated houses are unnecessary in New Zealand for the production of first-class blooms from most bulbous subjects. Though on the whole they are easily grown, they will not tolerate neglect, such as too little or too much watering or excessive exposure to brilliant sunlight, but with reasonable care they will produce flowers of a quality surpassing that of the best outdoor-grown bulbs of similar species and varieties.

Bulbs for greenhouse culture should be the best available. Growing plants from poor-quality bulbs or plants of old and very common varieties is a waste of glasshouse space.

A good standard potting soil for most bulbs can be prepared by mixing 2 parts of good rich loam and 1 part of fibrous or very gritty soil such as is available from used potting mixtures; to each 5 buckets of this mixture is added 1 bucket of very well-decayed animal manure or garden compost and 1 bucket of fairly fine, clean river sand. An alternative mixture consists of 3 parts of loam, 1 part of leaf mould, and 1 of a mixture of sand and well-rotted manure.

Amaryllis (*Hippeastrum*) produces brilliant flowers in spring or early summer when the foliage is barely above the soil. The pot is prepared in the normal way with crocks at the bottom and a thin layer of fibrous material to assist drainage. It is filled to more than half its depth with the soil mixture and the bulb placed on top with the roots spread evenly. More soil is added and pressed firmly as filling proceeds until the level is about an inch below the rim of the pot. When potting is completed the bulb should be only about one-third in the soil. It likes to grow in a temperature of 60 to 65 degrees F. with adequate moisture to encourage foliage growth. The plant likes reasonable shade during summer. As the foliage begins to dry off, watering should be decreased and finally stopped when the leaves have died off, but the soil should not become completely dried out even in the resting season, during which the pots can be placed on their sides or upright under the greenhouse benches. About August they should be lifted on to the benches and watered to start them into growth for the new season. If conditions are normal, they should flower about 6 weeks after the first watering. Flower colours range from white, through pink and rose to crimsons and reds.

Chionodoxas are small bulbs and can be grown successfully in 3in. pots. They are potted in the normal way for most bulbs—with their noses only slightly below the soil level when potting is completed—and should be stood outside or in a cool frame under a cover of cinders or ashes until they have made root growth. Any time after the shortest day they can be removed into the greenhouse and watered. They are excellent subjects for growing in pans or shallow bowls for house displays. Their chief value lies in the earliness of their pretty blue flowers.

Crocuses should be potted in March and plunged outdoors under ashes for 6 weeks or so—until they begin to root. They should then be given glass protection and cool conditions until the beginning of August, when the temperature can be increased to about 55 degrees F. for flowering. The larger-flowered varieties are probably most satisfactory for pot culture.

Freesias have been hybridised extensively of recent years and colours of a wide variety have been produced. They can be grown satisfactorily in temperatures down to 45 degrees F. They are potted about February or March with 9 or 10 bulbs to a 5in. pot. Leaf mould can well be omitted from the soil mixture for freesias, and they do not mind if the loam is rather heavy. A thin layer of fine river sand immediately beneath the bulbs seems beneficial. After being potted freesias can be placed in a cold frame without an ash covering, but the pots must not be excessively dried by the sun. They may be moved to an airy position in the greenhouse during May, and a temperature of about 55 degrees F. is ideal for their growth. The foliage may become lanky and fall sideways, but this can be overcome by placing a few bamboo sticks around the edges of the pot and joining them with raffia or light string..

Hyacinths: Good hyacinth bulbs are well worthy of greenhouse culture and the reward is always satisfying. Good-sized bulbs should be potted up before the end of March, each in a 5in. pot with the nose about at soil level. A ½in. layer of sand under the bulb encourages root growth. They should be watered well and placed outside or in a cool, dark frame under a covering of ashes, which can be as deep as 3 or 4in. over the tops of the pots. Six weeks is long enough to leave them plunged in this manner. By then the flower buds will have come well away from the bulbs, which may be lifted out of the plunging material and, if outside, placed in a cold frame. High temperatures should be avoided to prevent lanky foliage growth and soft, weak flowering stems from the end of July onward when they are moved to the greenhouse. Bulbs of normal bedding grade are usually potted about 3 to a 5in. pot.

Irises are exceptionally easily grown provided they are given good drainage. A covering of ashes is not required, and cool conditions make for stronger plants, better colour, and longer-lasting blooms than do high temperatures. *Iris tingitana* is the earliest to bloom and may be brought to flower about mid-June. Five bulbs are planted in each 6in. pot during March and grown in cold frames until May, when they are moved to an airy part of the greenhouse. The temperature should not be allowed to rise above 50 degrees F. Species such as *Iris histrioides, I. alata, I. susiana,* and *I. reticulata,* commonly referred to as the miniature irises, are very satisfactory for growing in shallow pans and thrive at the lowest average temperatures the cool greenhouse can provide.

Ixias are very useful and colourful greenhouse bulbs. They should be potted up during March with the noses of the bulbs just below the soil and may be grown in full light from the beginning. They should be watered carefully and the soil never allowed to become very wet or waterlogged. If the temperature is allowed to exceed 45 to 50 degrees F. for long, flower spikes are long, thin, and rather unsightly. As flowering begins ixias should be given full sunshine, which increases the intensity of the colour of the blooms.

Lachenalias can now be obtained in a great variety of colours, which greenhouse culture brings to perfection. The bulbs should be potted about the beginning of February in a reasonably open soil with a base of the best type of loam available. The noses should be just covered and the soil moderately firm but not hard. The pots are then stood in shady frames and watered well. They may remain there until May provided they are not likely to be frosted. They do not require heat, an average temperature of 45 degrees F. being the most satisfactory. Lachenalias are suitable also for growing in hanging baskets, all round which the bulbs may be placed at 3in. intervals. Such baskets are watered by being immersed in a tank of water which has been very slightly warmed.

Narcissi: The most common fault in pot growing of narcissi is too great a restriction of the space for root development. Not more than 4 large bulbs should occupy an 8in. pot. The soil must be rich for good results. Potting should be firm and completed by the end of February. The pots are plunged in ashes to a depth of 4in. over their tops and remain thus for up to 2 months. During June they may be moved into the greenhouse and kept at a temperature of about 55 degrees F. Experience will show that better results can be obtained by varying the potting time for different varieties.

Nerines are probably the most brilliant of the better-known autumn-flowering bulbs, and they are extremely easy to cultivate. They may be potted during November, December, or January, according to their resting period in the district, either 2 or 3 to a 5in. pot according to the size of the bulbs. The flowers appear during February and always precede foliage. From as soon as the bulbs appear to be growing, plants should be kept well watered throughout the flowering period and all the time the foliage is green. About October the foliage will have died and the pots can be placed in full sun and the soil allowed to become perfectly dry. Nerines may be grown in the same pot for up to 4 years, so when growth begins in the

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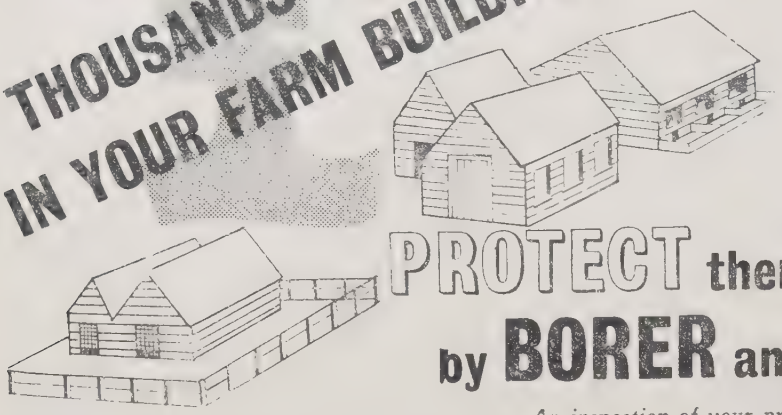

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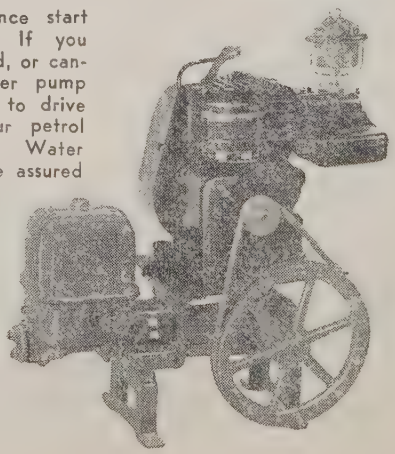

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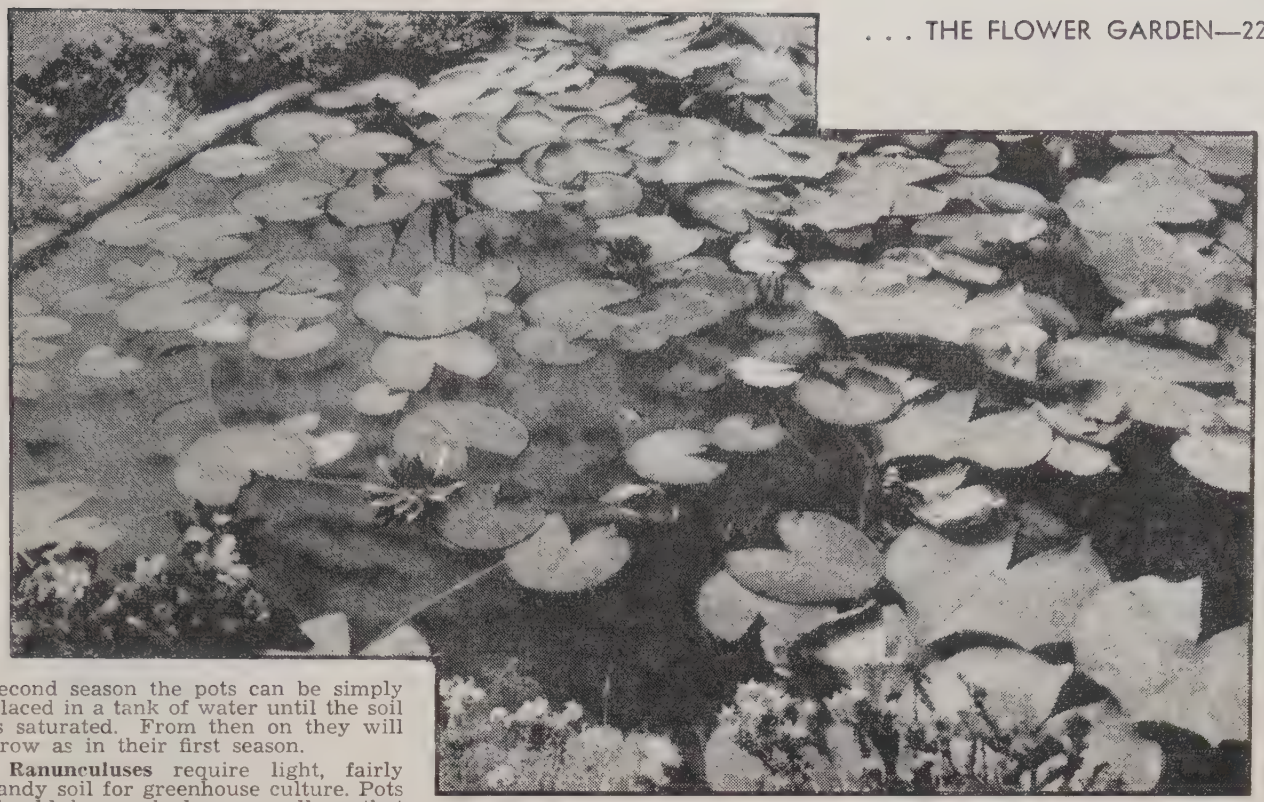

[*Photo News Ltd. photo.*

Water lilies may be removed from their tubs or baskets during October and the soil replaced before they are repotted.

second season the pots can be simply placed in a tank of water until the soil is saturated. From then on they will grow as in their first season.

Ranunculuses require light, fairly sandy soil for greenhouse culture. Pots should be crocked very well so that excellent drainage is provided, and the roots, which can be potted in autumn or spring, should be placed just below the soil surface. They should be grown in cool conditions such as are provided by a cold frame and they do not require to be covered with plunging material.

Scilla: *S. sibirica,* the culture of which is easy, can be brought to bloom in July in cool greenhouses in the colder parts of New Zealand. The bulbs are potted about 6 to a 3in. pot at any time during autumn and are not particular about soil. They are left in frames until the gardener wishes to move them into the greenhouse, which can be at any time during winter, and they will flower 3 to 4 weeks after being moved into the warmer conditions.

Snowdrops (*Galanthus*) can be potted up during February and placed in a shady cold frame until June, when they are moved into the cool greenhouse. They will not tolerate high temperatures. The giant form *Galanthus byzantinus* is best for greenhouse culture.

Vallota (Scarborough lily) is a close relative of the *Hippeastrum* in the amaryllis group. It retains its foliage, which consists of only a few strap-like leaves, during winter. It flowers somewhat irregularly during late summer and autumn, the blooms being scarlet, trumpet shaped, and carried a few to each stem about 18in. above the soil. The bulbs should be potted during autumn in much the same way as *Hippeastrum* bulbs and need not be repotted for 2 or 3 years. The vallota enjoys cool conditions, with an abundance of water during summer and only enough during winter to prevent the soil from drying out completely. *Vallota purpurea* is the one most commonly grown.

Flower Garden Work for October

Annuals sown in the open during September should have germinated by the middle of October. As soon as the seedlings can be handled easily they should be thinned to about 2in. apart; those removed may be used to fill gaps. The plants should be thinned again when they have established themselves more firmly. Dwarf varieties such as alyssum should be thinned to a minimum of 8in. apart, vigorous types such as godetias should be at least 18in. apart, and 10 to 12in. is adequate spacing for such types as cornflowers, candytuft, and pot marigolds. If plants are allowed to grow too closely, they starve each other, premature flowering is induced, and the plants seed and die early.

Bedding plants may be set out from their boxes in October, but planting out of such tender varieties as salvias, petunias, and zinnias should be delayed until late frosts are unlikely. The plants should first be thoroughly hardened off in the boxes by being left for a period in a cold frame or in the open protected by a scrim cover. Such hardened plants are less likely to be damaged by light frosts than are those planted directly from a glasshouse. Boxes of bedding plants should be watered thoroughly a few hours before the plants are to be set out to ensure that they do not lack moisture and to make lifting of the plants from the soil easier and less likely to cause damage to the roots.

Begonia cuttings rooted in a greenhouse can be potted up into 3in. pots as soon as the roots are considered to be sufficiently developed. A potting mixture strongly recommended can be prepared by mixing together the following constituents: 7 parts by bulk of sterilised loam, 3 parts of peat or leaf mould, and 2 parts of coarse sand, plus 1½oz. of dried blood, 1½oz. of superphosphate, ½oz. of muriate of potash, and ¾oz. of carbonate of lime to each bushel of the compost.

Biennials such as sweet william, myosotis, and canterbury bells can be sown in boxes outdoors during October.

Chrysanthemum cuttings made and inserted in the rooting medium during September should be rooted about 3 weeks later. They should be hardened off preparatory to being planted out. When they are planted the top should be nipped out of any plant which has not begun to produce side shoots. Where frosts are severe planting out of newly rooted cuttings is better delayed until November. Shoots on old chrysanthemum plants left in the border from last year should be reduced in number as soon as they are a couple of inches high. There is still time to lift and divide old clumps provided the shoots are not longer than a few inches. Chrysanthemums should be planted in borders in groups of 3 and 4 plants of the same variety to give an appreciable amount of one colour at flowering time.

Dahlia tubers boxed up in a warm place during August and September will be making good growth of new shoots, some of which may be removed to be used as cuttings. The clumps of tubers can still be pulled apart and the pieces replanted; each piece must have at least one strong shoot.

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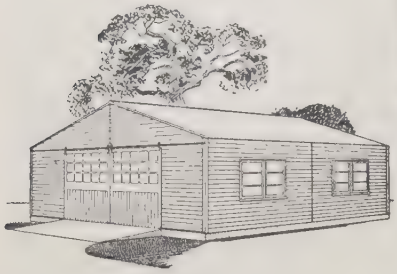

Sizes: 8ft. x 8ft., 8ft. x 16ft., 8ft. x 24ft., etc. 10ft. x 10ft., 10ft. x 20ft., 10ft. x 30ft., etc. 20ft. x 20ft., 20ft. x 30ft., 20ft. x 40ft., etc.

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Evergreen shrubs are best transplanted in early spring. Removal of a few shoots or branches relieves the burden on the roots, and the hole should be large enough to take the roots fully outspread. When transplanting is finished the new soil level should be at the position on the stem marked by the old soil level.

Fuchsias should be pruned during October if the work has not been done already. All old, dead, weak, or straggly shoots should be cut out and healthy shoots shortened back, the strongest to about 6in. and the weaker to about 1in. from their bases.

Geraniums, though tolerant of some frost on their leaves, are readily killed by severe frosting of the roots. In cold districts where the plants are lifted in autumn and stored in a frost-free place they should be planted out again in October. The plants should be cut back rather severely to encourage vigorous new growths and shapely bushes.

Gladiolus planting can be continued during October in any district.

Herbaceous plants such as delphiniums, lupins, pyrethrums, and hollyhocks can be raised readily from seed sown in open beds or in boxes or pots outside during October. Named varieties must be propagated vegetatively, and cuttings of young shoots taken from the growing plants in spring will root easily in a cold frame.

Lawn edges should be trimmed each spring at an angle of about 45 degrees away from the grass. This ensures a firm edge that will not break away when trodden on or when a lawn-mower wheel accidentally runs over it. This trimming should not be done until possibility of frosts has passed, because frosts loosen or "heave" the soil.

Rhododendrons often set seed after the flowers have faded. The seed pods should be picked off as they develop. If old, straggly bushes are cut back hard as soon as the flowers fade, no blooms will be obtained next year, but the mass of young growth that results will soon build a shapely new bush.

Green and Hahn Photography Ltd. photo.
Looper caterpillars, control measures for which are described on this page.

Water lilies grown in baskets or tubs may be removed from the water in October and have most of the mud washed away from them and replaced with equal parts of good garden soil, well-rotted animal manure, and sharp sand. The roots must not be allowed to dry out during this operation. While the water lilies are out a good opportunity is provided for cleaning out the pool.

Pests and Diseases

Greenflies are likely to appear in numbers during October on a variety of plants, including roses. At its first appearance this pest should be sprayed, preferably on a warm day, with nicotine sulphate at the rate of 1 part in 800 parts of water, or ½ fl. oz. to 2 gallons of water. To each 2 gallons of this mixture should be added 1oz. of soft soap or 3 fl. oz. of summer (white) spraying oil. This spraying should be repeated at 10-day intervals until no greenflies remain.

Looper caterpillars, the larvae of the silver Y moth, are very troublesome on a wide range of garden plants during spring. They are often common on dahlias, geraniums, and salvias. The caterpillars grow to about 1¼in. long, are light green with white and darker-green stripes on their backs, and are almost hairless. They eat from the lower surface of the foliage, leaving only a thin skin of upper epidermis which ultimately dies and falls out to form holes. The caterpillars arch their bodies and move in a series of loops. They can be controlled by a spray consisting of 2lb. of arsenate of lead powder to 100 gallons of water. Dusting with D.D.T. or derris is also effective.

Slugs and snails become very numerous and do a great deal of damage during spring, especially to young plants and seedlings. Hedgehogs, natural enemies of slugs and snails, destroy appreciable numbers of them, but poison baits probably provide the best method of control. Metaldehyde, sold as a solid fuel in oblong white tablets, is extremely poisonous to slugs and snails. One tablet should be crushed and mixed with 2 handfuls of wheat bran or dried blood, which is sprinkled lightly over the areas frequented by the pests. If rain falls within 24 hours of the application, repetition of the treatment may be necessary.

Tulip stripe or "breaking" is a virus disease carried from plant to plant by greenfly. The flowers develop abnormal streaks of colour and the bulbs, though they usually continue to grow and multiply, will never be free from the disease. The gardener should watch carefully for streaked buds, and affected plants, including the bulbs, should be dug and burnt immediately. A careful watch should be kept for greenflies feeding on the foliage or flowers, and a spraying with nicotine sulphate should be given at their first appearance.

Pieris japonica

A CHOICE evergreen shrub, *Pieris japonica*, formerly known as *Andromeda japonica*, has shiny, dark green leaves and bears showy racemes of small, pitcher-shaped, white flowers resembling lily of the valley sprays. There is also a very effective variegated form. The soil recommended for this shrub should be of the same general character as that recommended for rhododendrons—as free from lime as possible and containing humus in the form of peat, leaf mould, and the like. It requires a sheltered, half shady, well-drained position, though during the growing season it needs plenty of moisture if the position tends to be dry. Growths may be thinned out after the shrub has flowered if they appear crowded, and long shoots may be shortened if necessary to preserve the shape of the bush.

Plants are usually propagated from seed sown in autumn or spring or by layering in autumn. Seed should be sown on the surface of very fine, peaty soil in well-drained pans or boxes and covered with the merest sprinkling of fine, silver sand. The containers should be protected and shaded with glass and brown paper until the seeds have germinated. The quicker method is to layer strong young branches if they are available. After the usual "slicing" or "ringing" to restrict the flow of sap the branches are pegged down firmly into a mixture of peat and sand and kept moist.

—H. P. THOMAS, Vegetable Instructor,
Department of Agriculture, Wanganui

Photograph by Broadway Studios.

WOMEN who enjoy hand sewing usually delight in stitching lace edges and insertions on to their fine underwear. There are others who appreciate such luxuries but who can seldom spare time for the necessary labour involved. The more usual ways of sewing lace on to a garment and some suggestions for easier and less time-consuming methods are described in this article by Helen Paine, Rural Sociologist, Department of Agriculture, Wellington.

ALL lace should be treated carefully both during laundering and storage. A warm, dry atmosphere is the least likely to allow a mould to develop on lace that is not being used, though it may still be necessary to air the lace periodically.

Laces should be washed in a neutral soap solution and then well rinsed. The ideal treatment for a really good handmade lace is not to iron it, but to pin it carefully into position on a towel or some other material which will absorb the moisture and let it dry. But this is too troublesome for ordinary laces which can be ironed quite successfully as long as care is taken to ensure that the point of the iron never catches and breaks the fine threads of the lace.

When lace is sewn on to a garment thread should always be chosen to match the lace rather than the garment.

Methods of Sewing on Lace

Following are five methods of sewing lace on garments. Samples of work done by the first three methods are illustrated on the next page.

Hemming and Whipping

The most usual method of sewing lace on to a garment is first to hem the raw edge of the material and then to whip the lace on to the hemmed edge. If this is neatly done, if the hem is sewn with small stitches, and if the lace is whipped so that the stitching hardly shows, it is a most attractive finish for the edge of a garment. It requires some skill, however, to achieve a well-finished appearance and a little extra patience for the two rows of stitching necessary.

Satin Stitching

It is unfortunate that one of the strongest and most attractive ways of sewing lace is also the most laborious. Lace satin stitched on to a fabric undoubtedly looks well, and if it is considered worth the time and effort to use this method, the finished appearance is most rewarding. It is wise to use only the best lace and good materials so that the work will not be wasted on a short-lived garment. The heavier satins and crepes, rather than delicate sheers, should be chosen for this type of finish, because satin stitch gives a solid effect that might look out of place on a light material.

Rolling and Whipping

For fine underwear a method of rolling the edge of the fabric between the thumb and forefinger and whipping the lace on to the rolled edge is especially suitable. The edge of the fabric is rolled a little ahead of the lace, and so is sometimes difficult to manipulate, but once the technique has been mastered this method of sewing on lace will be found to be very quick and convenient. There is only one layer of stitching to sew, and the hem is very small and unobtrusive. This finish is quite unsuitable for materials which fray, because the whipping is not adequate to hold the threads in place, but it is particularly suitable for materials which stretch. As long as the material stretches evenly and is elastic enough to shrink back into shape, it simply serves to gather the lace on to the material. The gathering is very slight and can be most attractive.

Lace Insertion

A lace insertion is usually added to a finished garment as a decoration. The lace is tacked into position on the right side of the material and then stitched down at the edges by hand or by machine. Then on the wrong side of the material the fabric is cut away from behind the lace, leaving just enough to roll back and whip.

All-over Lace Edging

All-over lace is often used inset into a garment as edging or as a border frill. The right sides of the lace and the material are placed together with the raw edge of the lace overlapping the raw edge of the material by about ¼in. A line of stitching is sewn to join the fabric and the lace. The seam is then ironed flat, after which the raw edge of the lace is turned in and doubled back on to the material of the garment and hemmed. The other edge of the lace is finished with a narrow lace edging which can easily be frilled. A small hem on the all-over lace is turned over and the lace edging sewn on to it, care being taken to see that it catches the hem.

Sewing Lace by Machine

All the methods described of sewing lace on to a garment have been hand methods. There are, however, some

Lace sewn on to a garment by the hemming and whipping method.

satisfactory methods of sewing lace on to a garment by machine to speed up the otherwise-laborious process, and three are listed below.

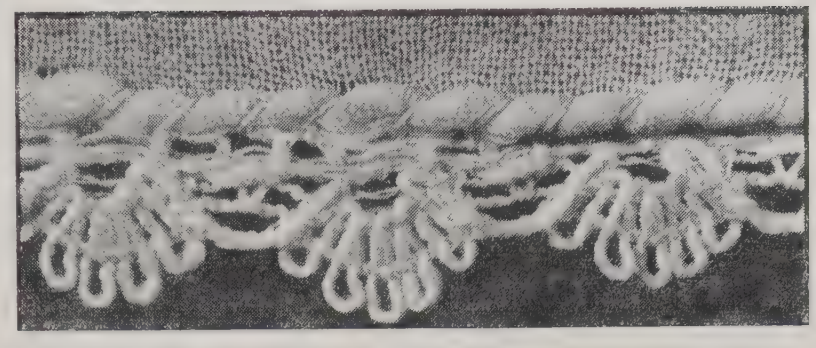
First, a hemmer attachment on the machine saves much ironing and tacking. With this attachment a neat hem is turned in and stitched while the sewer simply guides the material into the attachment. While the hem is being turned down by this attachment lace can also be guided into the attachment from another position and stitched on to the garment at the same time.

This method can be used to finish off the edge of a garment, or as an easy way of tacking the materials for rolling and whipping lace. If a large machine stitch is used, a tacking stitch that hems the garment also secures the lace on to it. Then the lace can easily be whipped on to the material by hand and the machine tacking removed when the process is complete. The machine tacking serves to hold the materials in place and so eliminates the awkwardness of the rolling and whipping method and yet shows the same finished effect.

Method of sewing insertion lace into a garment. A—Fabric cut away above insertion. B—Edge of fabric rolled and whipped.

Second, the machine hemmer attachment can be used to neaten the edge of materials cut away from insertion lace.

Third, a lace edging can easily be sewn on to all-over lace by machine; and a frill of any sort of lace or other similar edging can be conveniently gathered on a machine.

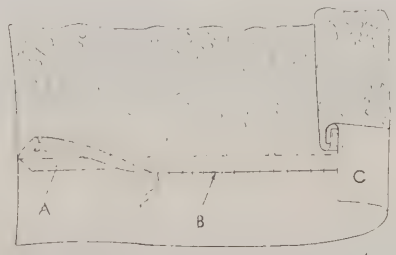


The rolling and whipping method of sewing lace.

Joining Lace

An edging of lace is often joined to an insertion lace at the border of a garment. With the outsides of the two laces facing each other, the two edges should be whipped together with a stitch that is loose enough to allow them to lie flat. If this seam is sewn by machine, it is necessary to use a large stitch to get the same effect.

To join lace the pieces should be placed together overlapping so that the pattern blends and a line of threads



Method of sewing on all-over lace or similar material with a raw edge to be attached. A—Two wrong sides stitched together. B—Raw edge of lace turned in and slip stitched. C—Right side finished.

that corresponds on the top and bottom pieces should be buttonholed. If the lace is very coarse, it is probably wise to use a strong satin stitch to sew the laces together, but if the lace is light, it may be possible to use a whipping stitch. When the two pieces of lace have been joined the overlapping lace should be cut away close to the stitching.

Lace can be joined at a corner by lapping the edges at right angles so that they lie perfectly flat; the pattern should be matched as closely as possible as it goes around the corner. The lace pieces should then be joined as previously described and the overlapping material cut away.

Gathering Lace

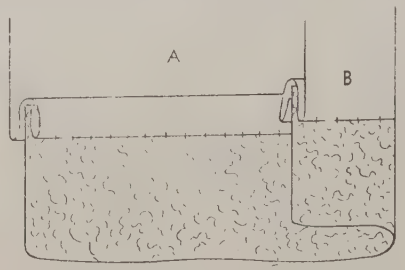
Lace can be gathered quite simply by pulling one of the threads on the straight edge of the lace. One of these threads usually runs the whole length of the lace; it can be pulled up to the required amount and the fullness spread out evenly.

Lace Medallions

Lace medallions, like lace insertions, are only a decoration to be added to a finished garment. These should be first tacked on to the material so that they lie flat and should then be satin stitched on firmly. Last, the materials should be cut away from underneath the medallion. Such decorations as these are not worth the extra trouble unless they are of the best quality, in which case they should be sewn on by hand. No machine stitch is sufficiently attractive for sewing decorative motifs on to a garment.

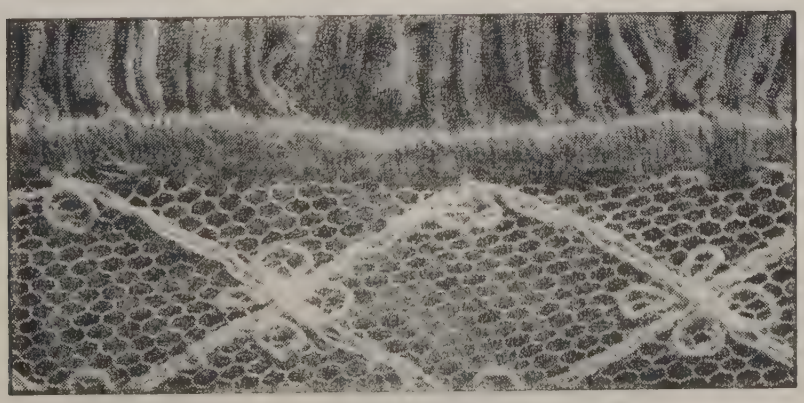
French Hem

To make a French hem for insertion lace or lace edging, the raw edge of the material is turned into an ordinary small hem, showing on the right side



French hem. The normal hem on the right side is doubled back and the lace is inserted and hemmed in. A—Wrong side. B—Right side.

of the material instead of the wrong side. The whole hem is then doubled back on to the wrong side. This leaves a fold between two layers of material into which the lace can be inserted. One line of stitching then serves to hem the edge and sew the lace on to the garment.



Satin stitching of lace on to a fabric.

The Farmhouse Kitchen in New Zealand

THERE is little in the modern farmhouse kitchen in New Zealand to remind one of its predecessor of 100, 50, or even 30 years ago. Though perhaps no one will regret the passing of the pioneer kitchen and all it meant in long hours of back-breaking labour, it is fitting to recall the difficulties which beset the wives of the settlers even in the preparation and cooking of the simplest meal. This article is the first of a series of three by Evelyn E. Moore, Rural Sociologist, Department of Agriculture, Palmerston North, which deals with the evolution of the farm home kitchen since the pioneer days. In this article she describes the hardships on the emigrant ships from Britain and during early settlement, and in the second article, to appear in next month's issue, she will discuss, first, the resourcefulness of the pioneer women in overcoming severe food shortages and, second, the improvements which were slowly made to the farmhouse kitchen.

THE articles in this series try to describe one important aspect of the daily struggle of these women to provide their families with comfortable, pleasant homes; that is, the preparation and cooking of meals in surroundings and under conditions which today might cause many to shudder. They discuss also the great improvements farmers' wives were able to make through the years with the usually rather inadequate sum of money left over from improving the farm, adding necessary bedrooms, and even from building a new home, for it was not really until after the First World War that the need for intelligent kitchen planning began to be generally recognised. Until then, unless a housewife was very strong minded, the arrangement of the kitchen was inclined to be fortuitous or left to the builders, who, however competent they may have been, seem to have been entirely devoid of any knowledge of meal preparation, if the kitchens they built are any criterion.

Enthusiasm for Pioneer Life

The journals and letters of the women in the early settlements show that cheerfulness and enthusiasm for pioneer life were general, and it seems that they considered its discomforts more than compensated for by their increased freedom and opportunities for using their initiative, in spite of the disillusionments of lack of food, work, and money, for at one time or another most of the early settlements were in financial difficulties. For example, one woman wrote to her friends: "I am so proud at finding how easy it is to be independent. My Mother talks about not being able to bear my being a slave, but I feel myself less a slave now that I can do everything for myself than I ever did before." Later she wrote: "Everything you see is your own—the absolute possession of land gives a sort of certainty you are in what may be your home till death. We feel ourselves, too, members of an infant state which will every day become more important, and the smallness of our affairs does not make them contemptible when they are felt to be the germs from which great things will grow."

This woman, probably better educated than many of the settlers' wives, expresses clearly what were doubtless the feelings of many. Lack of opportunity at home, together with this spirit of independence without which few would have been willing to endure several months in the small, acutely crowded, and uncomfortable emigrant ships, explains perhaps the success with which they overcame the hardships which were an invariable part of the lives of pioneer women and made possible the present high standard of living enjoyed by New Zealanders.

Need for Initiative

From the moment they embarked the pioneer women found need for all the initiative they possessed. Conditions varied greatly from ship to ship, but all emigrant ships seem to have made

HEADING PHOTOGRAPH: An early cob farmhouse in Otago. This illustration shows the primitive conditions under which the pioneer women had to work. The photograph is from the Alexander Turnbull Library photographic collection.

the same general provisions for passengers. The first or chief cabin passengers, though they had a steward to cook their meals, received virtually no other services. Evidence that the food was extremely monotonous is shown by their letters home to intending emigrants, advising them always to bring such luxuries as cheese, dried fruits, sweet biscuits, fruit cake, and tea with them.

Steerage and fore cabin passengers were supplied with even more monotonous food, as they were not given the occasional allowance of a little milk and freshly killed meat which the chief cabin passengers received; in addition they had to supply most of their cooking utensils and to do their own cooking. The food, though generally adequate, was similar on most ships, and a week's ration per person generally consisted of 3½lb. of salt meat, 5¼lb. of ship's biscuits, 1 pint of peas, 8oz. of raisins, 12oz. of fat, 21 quarts of water, 2oz. each of tea and coffee, and 3½lb. of cereal. Potatoes were also usually carried and while they lasted replaced some of the cereals, and on many ships limejuice was issued regularly.

For the person taking his turn as cook life seems to have been one long struggle to get meals cooked and served up to his hungry and dissatisfied messmates. In most of the ships the galley was hopelessly inadequate, not surprising in a 400- or 500-ton ship carrying between 200 and 300 passengers.

The cook had to prepare the porridge in the dim and tiny cabin and go to the galley to wait his turn for the fire, frequently for as long as an hour if he were a late arrival. Then, as one emigrant describes it, provided he was fireproof and could bear being parbaked by the enormous fires, he would ultimately get his porridge cooked, and, collecting his ration of muddy, black coffee, make his precarious way across the deck to the cabin, often, if a rough sea were running, to have it doused by the spray or even see it washed completely away.

Dinner consisted of salt meat and ship's biscuit or a duff frequently under- or over-cooked, as there was no system in arranging cooking times. For tea there would be ship's biscuit or bread and tea, often apparently a most nauseous brew, because the water was procured with slight regard for its cleanliness and frequently became bad in the closed casks in which it was kept. One passenger described the tea as "something like rotten eggs, and some days as if it had come out of a clay hole". It is not surprising that typhoid often occurred aboard the emigrant ships.

Life was most hard for emigrants to new settlements, and after a 3 to 6 months' voyage the settlers found their difficulties aboard ship only an introduction to their troubles. Usually few preparations had been made for their housing or comfort, and the discomfort of living in raupo huts which had no flooring, chimney, or window, and which were neither windproof nor rainproof, until better houses could be built was endured alike by the wives of the missionaries early in the 19th century and by the womenfolk in the pioneer settlements.

Advantage of Shipboard Experience

Fortunately most of these women had their shipboard experience of cooking and housework under primitive conditions as a background for their life in the bush. Others, like the wives of the Scottish crofters, had lived only in two- or three-roomed cob or stone cottages with a living-room kitchen where all the cooking had been done over a big, open fire which occupied one complete end of the room and which was fitted with a "sweigh", a hinged iron crane that swung away from the fire so that the heavy cast-iron pots or girdles could be conveniently tended. This open-fire cookery was not such a disadvantage in a country with comparatively cool, brief summers, but must have been extremely trying to the women through the long, hot New Zealand summer days.

Maori Oven Seldom Used

It is to be expected that on their arrival in a new country these women should prefer to retain as many of their homeland customs as they could. Consequently, though many of them knew, at least in theory, how to cook in a Maori oven, they seem to have used it very seldom.

That these ovens were by no means simple to use seems apparent from a detailed description given by one

BELOW: The V huts characteristic of the Canterbury settlement were popular because they required the minimum of timber. Sails from ships were often used for roofing, as is shown in this illustration of a reconstruction of Studding Sail Hall, built by Dr. A. C. Barker in 1850.

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Many of the early settlers brought all their furniture and china with them from overseas. Despite the hazards of long journeys overland, most of the articles were brought safely to the new homes and were proudly displayed on open dresser shelves.

woman who had been travelling in a party accompanied by Maoris. "A shallow round hole one yard across was lined with hard stones about the size of a duck's egg, on which dry wood was piled and burned. Puha (sow-thistle) or cabbage leaves (a variety of wild cabbage possibly introduced by Captain Cook) were then laid on the stones, the food to be cooked was placed on these, covered with wet matting, and earth was finally heaped on top to a depth of several inches. Water which, falling on the hot stones, created the steam for cooking was poured through a hole left at the top. The hole was then closed with earth so that no steam could escape and the food left until it was cooked."

It is scarcely surprising that most women preferred to use an iron pot, "go-ashore pot", or camp oven over an open fire. The go-ashore pot, which was probably first used by the whalers, was deep and round, curving in slightly at the top, and with three short legs to stand on the fire. It had a lid on which embers could be placed for it to be used for baking. Its curved top and sloping lid, however, made it awkward to use for this purpose. There is recorded an occasion when a precious Christmas pudding so swelled that it could not be lifted from the pot and had perforce to be served inside it, an incident which would doubtless not endear the go-ashore pot with the cook.

Consequently the camp oven rapidly superseded it and is, in fact, still used today. Shallower and with sides sloping slightly outward, about 15in. across and 5 to 6in. deep, it was made of heavy cast iron so that it heated fairly evenly. It was a far more convenient shape for baking and had a lid with a slightly raised edge so that it would retain the embers used for keeping the top of the oven heated. In addition many placed an iron hoop slightly smaller than the diameter of the lid on top of it so that the embers could be more easily heaped on top.

At first fires were generally laid straight on the ground out in the open or in improvised fireplaces with a rough thatched roof which must often have served its purpose badly, as there are descriptions of women patiently holding umbrellas over the fire while the meal cooked; a less pleasant task can scarcely be imagined.

Varied Types of Early Houses

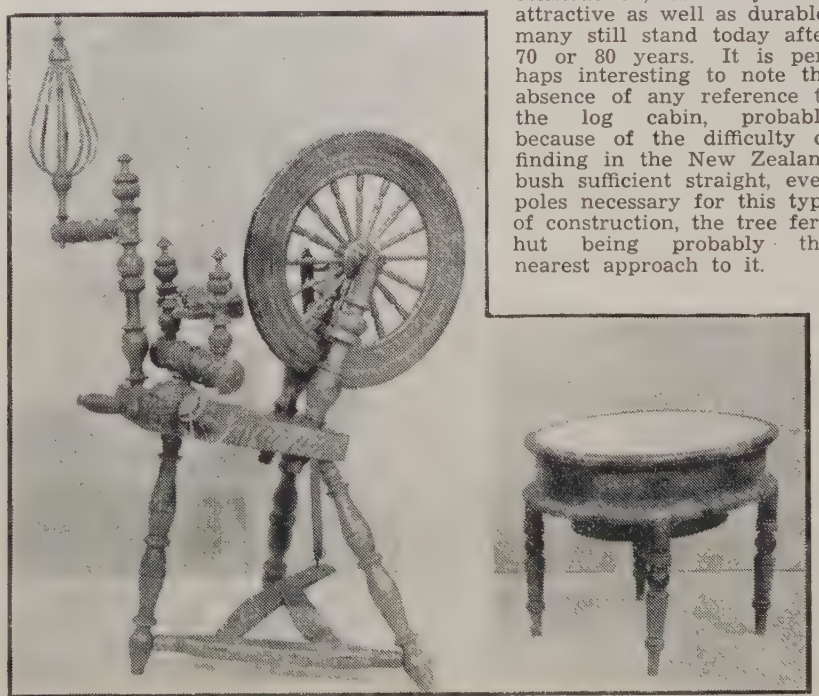
The first task of all new arrivals was, of course, to build some sort of shelter as quickly as possible. These hastily erected dwellings varied in different districts according to the presence of good timber, the pioneering knowledge of the settlers, and other factors. In Taranaki, parts of the Wellington Province, North Auckland, and districts where good timber was plentiful, slab huts were common. These consisted of a framework of poles sunk 2 or 3ft. into the ground and walls of slabs fitted as closely together as possible, with the spaces filled in with a thick clay plaster. The roof was of shingles or thatched with raupo, toi-toi, or nikau leaves (the most satisfactory when they were obtainable).

In other settlements wattle and daub huts with thatched roofs were popular. The framework was of posts, with thin saplings (called wattles) nailed or tied with flax longitudinally on either side and close together. This was then plastered with a thick mixture of clay or clay mixed with straw or fern. According to comments in journals, this required frequent replastering at first, as the clay often cracked as the mixture and saplings dried out.

Where tree ferns were plentiful they were also used to make a most attractive hut, the rough trunks being fitted closely together on the framework and the inside plastered with clay.

One of the heavy and cumbersome charcoal irons used by early settlers. The top was removed and the hollow base filled with hot coals. The chimney at the right-hand end provided the necessary ventilation.

Other settlers less fortunate in the supply of bush or inexperienced in bushcraft utilised spare sails off the ships. In settlements where timber was scarce, particularly in Canterbury, V huts, which looked like a gable roof set straight on the ground, which had rafters and a ridge pole of manuka or light saplings, and which had thatched roofs of native grasses, were popular; in these it was possible to stand upright only in the centre. Sod or cob houses with thatched roofs were, however, more durable and soon replaced the V hut. Sun-dried brick houses were usually built later, as considerably more labour was needed in their construction, but they were attractive as well as durable; many still stand today after 70 or 80 years. It is perhaps interesting to note the absence of any reference to the log cabin, probably because of the difficulty of finding in the New Zealand bush sufficient straight, even poles necessary for this type of construction, the tree fern hut being probably the nearest approach to it.



This spinning wheel and baby's bath exemplify the furniture brought to New Zealand by early settlers.

These wooden buckets and bowl are typical of the early kitchen utensils made in New Zealand.

Windows were small and left open, or covered by a "calico glaze", and one end of the hut was occupied by the huge fireplace with a chimney so wide that hams or fish could be hung in it to be smoked. This was built either of cob, in which the clay was mixed with any satisfactory material at hand in place of straw, or, in bush districts, of a substratum of round timber plastered in the interior with clay as some protection against fire, or lined with stones. Sometimes a sweigh was fitted into the chimney, an iron tripod was used to hold pots, or the sides were built up to hold "dogs", iron bars which held the wood off the hearth. Where chimneys with a timber framework were used care had to be taken to build the fire in the centre of the fireplace to prevent the chimney from catching alight.

In continually wet weather, however, the pioneer women often considered themselves fortunate to have a fire at all. A fireplace which made cooking an arduous and often unrewarding task was the least of their worries, which anyone who has tried to light a fire in the bush on a wet day can realise. They had no means of keeping wood dry—apart from what could be stored inside—and on occasions had no firewood at all, particularly those on the Canterbury Plains. It is recorded that one woman had nothing but straw to cook with for nearly a year and others used native grasses; in the whaling settlements whale oil and blubber were burnt for cooking.

Primitive Furniture

The floor of the typical early kitchen-living room was of tramped clay, often a mud puddle in wet weather if the thatching or shingling had been badly done. The table was usually four lacebark or lancewood stakes driven into the ground with a packing case timber top planed down as smoothly as possible, and stools or seats were roughly made from packing cases, sawn-off blocks from tree trunks, and whale's vertebrae, a rather novel variety apparently popular near the old whaling stations.

Because few could afford the very high freights of the small, unreliable coastal sailing vessels or the cost of transport by bullock wagon or packhorse, equipment for the early bush home had to be carried by the settlers themselves and sometimes it had to be taken through rough, untracked bush. The equipment was therefore reduced to a minimum. The camp oven, usually the only means of making bread, was almost a necessity, and the cast-iron kettles, pots, and boilers of the times were far too heavy to allow more than one or perhaps two to be taken.

Most of the Scottish settlers seem to have taken their girdles with them, for their oatcakes and bannocks often meant more to them than bread, and a tin billy, pannikins, a tin basin, and a minimum quantity of china and cutlery completed the equipment.

In addition, if she were fortunate, the housewife would possess a candle mould, a charcoal or box iron (the Mrs. Potts irons came later), a milk-setting pan and skimmer, a wooden churn, and an oaken butter stamp.

With these, and without the advantages of the simplest labour-saving devices (she might have had to walk 50 or 100yds. or further to the creek for every drop of water she needed), she had to prepare and cook meals and clothe and do all the washing for her family, no light task, even with modern equipment, for the large family usual then.

The provision of food for an active, hungry family was always a major problem during the first years of settlement in New Zealand. The supply of European foods, milled flour, sugar, salt, tea, and coffee depended on the problematical arrivals of sailing ships from Australia, and at first these foods were often severely rationed even in the towns.

Because many settlers on back-country farms arrived with little more than food and clothing, pieces of furniture such as this stool had to be roughly fashioned from material at hand.

For the farmers' wives occasions when they found their stocks of these foods becoming dangerously low were more frequent, because floods, bush fires, or snow storms would sometimes hold up the trip to town for a week or more, and unexpected guests often made further inroads on the supplies, as country women's generosity and hospitality were such that no one was ever turned away without a meal, but was always assured of a warm and friendly welcome.

Care of Carpet Sweepers

MANY housewives using carpet sweepers that do not work efficiently blame the mechanism of the sweeper. A great number of the inefficient carpet sweepers drop dust or fail to pick it up because they are neglected and dirty, and they may need only a good clean to restore most of their lost efficiency.

CARPET SWEEPERS should be emptied after each sweeping. When the pans of sweepers are full the brush will still pick up dust, but this cannot go into the pans and so is simply thrown back on to the floor. It may be necessary to empty the pans before the sweeping is finished, but this depends, of course, on whether the carpet loses its pile easily or not and whether it is very dirty. However, the sweeper should be emptied after every job.

The brush should be untangled regularly. If it is tangled and matted together with hair, cotton, ravellings, and fluff, the brush cannot sweep well. Each bristle in each tuft must be free to flex and to flick the dust into the pan. To clean the brush take a large pair of scissors and cut all the tangled threads between the rows of bristles. The short threads left can then be pulled out quite easily. If the bristles become sticky, this can be remedied by rubbing the brush with a cloth dampened with kerosene or dry-cleaning fluid. The brush should not be washed in water, as this may tend to loosen the bristles.

When using the sweeper do not exert a lot of pressure on it, and do not push hard on it. It should never be jerked back and forth, but should be made to run smoothly with long, even strokes. While using it turn it round occasionally so that both the pans will take up the dirt. The manufacturer's directions should be followed in oiling and caring for the sweeper.

If the precautions set out are taken and due regard is paid to the cleanliness of the carpet sweeper, it will be much more efficient in use, will run more easily and quietly, and last much longer.

—*ANNA M. CHAPMAN,*
Rural Sociologist, Department of Agriculture, Dunedin

PRESERVING EGGS

IN many homes, whether poultry is kept or not, it is desirable to preserve eggs during spring or summer when they are plentiful and prices are low. Eggs properly preserved may be held for several months in a cool place and used during the following autumn or winter. The writer of this article, W. L. McIver, Poultry Instructor, Department of Agriculture, Hamilton, states that high-quality eggs are needed by the housewife for preserving and asserts that the duty to cater for this trade falls on the poultry keeper even more than on the storekeeper.

HOUSEHOLD poultry keepers, who run only a few fowls to supply their domestic requirements, are not concerned with selling eggs. A survey has shown that the average number of birds in a household flock is seven. In the larger towns and cities only about one family in ten keeps fowls, in smaller towns about one in five, and in country areas most households have their own egg supply. Seven fowls should almost supply the winter needs for most families and in summer there should be a surplus. Some of these surplus eggs are preserved, but many are given away to friends because small flock owners will not bother to take a few eggs to the distributors.

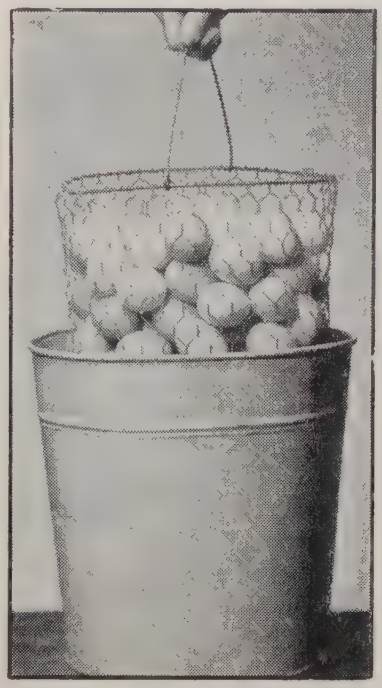
As eggs are given away only a few at a time, most householders depend on farmers and stores from whom to buy eggs for preserving, which is as well for commercial poultry farmers, because a market is required for summer surpluses. The pulping of eggs can provide some outlet, but preserving is another excellent avenue of disposal.

Judging Suitability of Eggs

The weight, size, and to some extent the shape of eggs do not matter for preserving, but only fresh, sound, and preferably sterile eggs should be used.

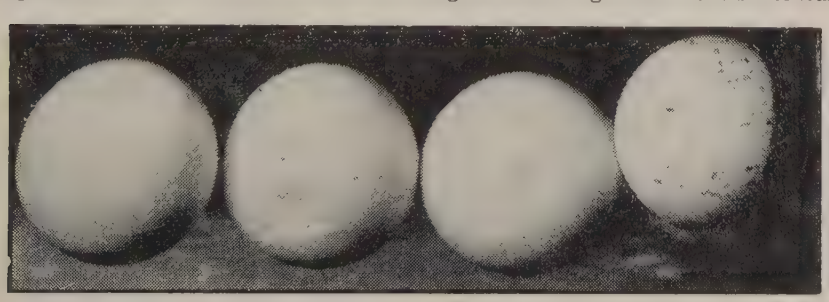
By their appearance alone the housewife cannot judge whether eggs are new laid, a week old, or even 4 weeks old if they have been stored properly. If the household flock does not produce enough eggs for preserving, the housewife must buy from the egg distributors or buy direct from a producer, to whom the importance of obtaining fresh eggs with sound shells can be explained.

Preserved eggs can be stored in tins or crocks of this type.



If the preservative is a liquid, a better method is to use a wire basket which can be lowered into a container. The eggs can then be removed readily.

The condition of the shell can be judged more readily. With a strong light—"candling"—the shell texture can be seen and eggs of poor shell texture graded out. The light will also show up large cracks. The presence of fine hair cracks can be detected only by lightly tapping two eggs together, turning them and tapping in three or four positions; sound will indicate whether they are cracked.



Dirty or cracked eggs and those with poor shell texture are unsuitable for preserving.

Method of Preserving

Of the many ways of preserving eggs at home the use of a waterglass solution is the most popular. Several excellent proprietary lines of egg preservatives are on the market, each giving working directions with the bottle. Twelve dozen eggs can be preserved in a 4-gallon tin, requiring about 2 pints of waterglass and 16 pints of water. At least 2in. of the solution should cover the eggs.

Boil the water and allow it to cool. Clean the tin or crocks thoroughly. When the water is cool pour it into the crocks and add the waterglass, mixing both ingredients well with a clean stick. The containers may be filled at once or the eggs added daily as collected. If the eggs are placed in a wire basket which fits inside the tin or crock, they can be taken out easily. Any additional liquid required can be added at the rate of 5 pints of water to 1½ pints of waterglass. Place a cover on the crock to reduce evaporation and store it in as cool a place as possible.

Preserved eggs are used chiefly for cooking. Waterglass eggs are less desirable for boiling, as the shell may burst in the boiling water, but they may be used satisfactorily in other ways.

Some housewives doubt whether waterglass eggs retain their vitamin content, but experiments with eggs preserved in waterglass for 6 to 9 months resulted in the report: "If there is any loss in vitamin content, it is so slight as to be unimportant".

One measure to adopt to ensure the keeping quality of eggs is to withhold male birds from the laying pen, for sterile eggs keep much better than fertile ones, especially during hot weather.

Photographs by Fraser Niederer.

The Technique of Washing Wool

THE virtues of wool lie in natural characteristics of the fibre, and they do not "wash out" or diminish on contact with water if the right methods are used. For the same reason, wool threads can absorb perspiration moisture without losing any of their elasticity. Success in washing wool depends in fact on obedience to the few golden rules which most women know almost instinctively. If these rules are followed, pure wool articles of every description can be sent to the tub over and over again and emerge with all their natural softness and loveliness.

WOOL and water, it may be said, get on very well together if properly introduced. For women who still hesitate to wash their wool garments as much as they might do, the following hints should prove of value.

Shrinkage

If wool is subjected to hard rubbing, coarse soap suds, extremes of water temperature, or any such ill treatment, the fibres tend to cling tightly together and become matted. The result is "shrinkage". This attribute of wool is valuable in that it makes possible the very useful materials known as felts, for felt is wool subjected to heat, moisture, and pressure to produce quite a different material.

The important point is that shrinkage or felting can be controlled and even prevented, either by careful washing or by special shrink-resisting treatments of the fibres which prevent them clinging together. Unshrinkable wool is now a fact, but that must not be taken as an invitation to careless washing. Whatever degree of shrink resistance is given to wool, the more carefully any wool article is washed the longer it will last and the better it will look.

Quick and Gentle Washing

A good article deserves careful handling, and a useful motto for washing wool is "Quickly and gently". Clothes should not be left to soak or kept wet longer than can be helped, and it is as well not to try to wash too many things together.

A good lather should be worked up with a mild soap and the suds squeezed gently through the clothes until the dirt disappears. All the soap should be completely dissolved. Really dirty garments may need a second lot of suds. Wool should not be rubbed or twisted, for hard rubbing or pounding is a common cause of shrinkage, which is merely the felting together of the fibres. The work should be done under water so that the weight of water in the garment will not stretch it; that is particularly important with knitwear.

Woollens must never be boiled. The water should be just hot enough to be comfortable and the temperature kept as near constant as possible. To wash wool in warm water then suddenly rinse it in cold is asking for trouble, for extremes of temperature may cause the fibres to felt and the fabric to shrink unless the wool has been made unshrinkable.

Every particle of soap must be rinsed out of the wool. That may mean several separate rinsings in successively cooler waters, but it is well worth it, as soap left in the wool tends to spoil its softness and delicacy.

Drying

The ideal is to dry wool garments quickly, preferably in the open air. If that is not possible, artificial heat should be treated carefully. Wool should never be draped on a radiator or close to a fire. After being rinsed, the clothes should be wrapped in a towel and as much moisture as possible squeezed out in the shortest possible time. Wringers should be set loosely. The garments should then be laid flat, pulled gently into shape, and left to dry.

Ironing

Knitted garments seldom need ironing at all but only careful shaping. Woven woollens should not be pressed until they are dry, and then only with a moderately hot iron gently on the wrong side of the material. A well-padded board should be used.

An Easy Method of Slicing Onions

A QUICK and easy method of slicing onions is to cut them only partly through from the top and the side instead of cutting each slice right through from one direction. The slices can be made thick or thin, depending on the fineness wanted, and the pieces do not slide all over the chopping board. Another advantage of the method is that it is possible to cut only as much as is required at the time; it is not necessary to chop the whole onion if it will not be used.

Take the onion and cut it into slices in one direction, but do not cut it right through. Turn it round and make slices at right angles to the first, still not cutting right through the skin at the base. Last, turn the onion on to its side and cut across the ends of the strips already made; these cuts will form cubes.

—ANNA M. CHAPMAN, Rural Sociologist,
Department of Agriculture, Dunedin

Celery Recipes

CELERY is one of the most useful vegetables. It matures just as the summer vegetables are getting scarce, and is useful for hot and cold meals. It appeals to the frugal woman, too, because practically every part of the celery plant can be used. The tender inner stalks, the tougher outside layer, and even the leaves and seeds are all edible. The celery season is long, but the vegetable can be used for a diversity of dishes. The making of some of these is described in this article by Helen Paine, Rural Sociologist, Department of Agriculture, Wellington.

CELERY is at its best when it is eaten raw, but only the fine, white inner stalks are suitable for this purpose. The outer stalks grow coarse-grained and stringy and are fit to eat only after they have been cooked. Raw celery provides an excellent winter substitute for the fresh tomatoes and lettuces used in summer lunches, its great advantage being that it is very easily transported. Celery with bread and cheese provides an excellent and healthy variation in a school lunch, which usually lacks fresh fruit and vegetables in winter.

Like almost all vegetables, celery is most satisfactory if it comes straight from the garden, but when it has to be bought it can be kept for several days if the stalks are placed in a deep jug of cold water.

The preparation of celery is very simple. Remove the outer stalks of the celery, reserving them for a cooked dish, separate the white, crisp stalks in the centre of the bunch, and wash them or brush them in cold water. If time permits, soak them in very cold water for half an hour and serve them in a glass of cold water or on a dish of ice.

Celery Used Raw

If on a special occasion a more decorative method of serving is suitable, raw celery may be curled or fringed.

Celery Curls

With a sharp knife cut the tops of the celery into a fringe for about 2in.; soak these stalks in cold water and the strips will curl. The stalks then have a light, attractive appearance, and may be used as a garnish or as the basis for a party savoury.

Celery may, of course, be used as the base for any winter salad, or as a complementary flavour to some other ingredient. Some simple suggestions are:—

Celery and Apple Salad

2 or 3 apples
6 sticks of celery
Lettuce leaves
Salad dressing

Cut the apple into small cubes. If the apple has a highly coloured skin, do not peal it off, but leave it to add colour to the salad. Cut up the celery into similar pieces and mix it with the apple. Pour enough salad dressing over the mixture to combine the two. Pile the mixture into lettuce cups and garnish it with parsley or cress. Variations on this salad recipe may be achieved by adding walnuts, cheese, or pickled cucumber.

Celery and Potato Salad

4 medium cooked potatoes
Celery
Radishes
Parsley
Chives
Salad dressing

Cut the potatoes into small cubes and mix them with chopped celery in a salad bowl. Pour a little salad dressing over the whole and sprinkle parsley and chives on top. Garnish with radishes and celery curls.

Soups

Celery salads are suitable for warmer weather, but for the depths of winter celery soups are likely to prove more popular. Of course, celery can be used to flavour almost any soup, but it can also be used by itself as the basis for a clear consomme or a nutritious milk soup.

Clear Celery Soup

6 sticks of celery
1 or 2 onions
1 or 2 carrots
Herbs and seasoning
Chopped parsley
2 pints of stock

To make the stock soak ½lb. of meat or a cracked bone in 2 pints of cold salted water. After soaking the meat heat the mixture slowly to boiling point; then simmer it for 2 or 3 hours or cook it in a pressure cooker for 20 minutes. Cool the stock and remove the scum. To make the soup dice the carrots and onions into very small cubes and chop the celery into pieces of the same size. Reheat the stock with the vegetables and add another pint of water. Season the soup to taste and garnish it with parsley before serving it.

Creme of Celery Soup

1 cup of celery cut into small pieces
1 cup of any vegetables diced

Cook all the vegetables together in 2 pints of water until they are tender. Make a thin sauce with 2 tablespoons of butter, 2 tablespoons of flour, and 2 cups of milk. Add the vegetables and the water they have been cooked in to the white sauce. Season the soup and serve it with a garnish of parsley.

Luncheon Dishes

Celery may be used as the main dish for a luncheon menu in a great variety of ways. The following recipes are a few suggested methods:—

Celery au Gratin

Several stalks of cooked celery
1 tablespoon of grated cheese

Any other cooked vegetables, for example, peas, carrots, or tomatoes, can be added to the celery to give flavour and colour.

Make a sauce of 3 tablespoons of flour, 2 tablespoons of butter, 1 cup of milk and stock mixed, and 4 tablespoons of grated cheese. Arrange a layer of vegetables and a layer of sauce alternately in a casserole dish, finishing with a layer of sauce. Sprinkle the top with grated cheese and brown the dish in a hot oven.

Celery and Onion Casserole

3 large onions sliced and cooked in a small quantity of fat
6 large sticks of celery boiled
¼ cup of dry breadcrumbs

Make a sauce of 4 tablespoons of butter, 4 tablespoons of flour, 1 cup of milk, and 1 cup of celery stock. Arrange the sauce and vegetables in layers in a casserole dish, sprinkle them with breadcrumbs, and brown the dish in a hot oven.

Celery can be used to advantage in many meat dishes, either as a vegetable in a stew or as a stuffing.

Beef Casserole

1lb. of beef
1 carrot, 2 onions
3 sticks of celery
1 tablespoon of fat
2 tablespoons of flour
1 cup of stock or water

Flour the beef and sear it in the fat until it is well browned. Place this meat cut into cubes in a casserole dish in alternate layers with the vegetables and the stock; then cook them in a slow oven for 3 hours. Thicken the casserole, if necessary, just before serving it, with a small amount of flour mixed to a paste with cold water.

Celery Meat Balls

1lb. of minced beef or pork
½ cup of chopped onion
½ cup of chopped celery
1 cup of fresh breadcrumbs
¼ to ½ cup of stock or gravy
1 egg (beaten)
Salt and pepper
Parsley

Mix the beef, onion, and celery with the breadcrumbs and moisten them with stock or gravy. Shape the mixture into balls; then dip them into the beaten egg and coat them with dry breadcrumbs. Bake the balls in a little fat in a moderate oven for ½ hour.

Celery Stuffing

3 cooked mashed potatoes
2 tablespoons of fat
3 sticks of celery
1 egg
1 onion
Pepper and salt, herbs to taste

Saute the onion and celery in fat and mix these vegetables with the mashed potato. Blend them with the egg and add the seasoning; then mix the whole well. Celery stuffing can be used for pork, game, fish, beef, or veal.

Celery Savouries

Celery is a stand-by at any party, as many new ideas can be conjured up from a few basic recipes. Here are two suggestions for stuffing celery.

Cottage Cheese Stuffing

Season cottage cheese with salt and pepper and finely chopped chives and press it into celery stalks. Cut the stalks into inch-long pieces.

Celery Cheese Eggs

Stuff wide celery stalks with soft, yellow cream cheese. Press the stalks together in pairs, and then leave them to set. Later cut the stalks in slices; the yellow cheese gives the egg-yolk appearance and the celery looks like egg white.

Celery Seed

If a large quantity of celery is grown, some can be allowed to seed. The dried seeds can be kept for use in almost any savoury dish. The addition of salt, pepper, and celery seed becomes a habit once it has been tried. Usually celery leaves are destroyed, but if they are kept they may be used to impart a delicious fresh flavour to soups and stews.

Vest and Pilch for a Baby

A SET consisting of pilch and short-sleeved vest is part of a baby's wardrobe for which most mothers find much use. Instructions in this article are for the knitting of the set illustrated to the following dimensions: Vest: Length, 10½in.; chest, 15in.; sleeve seam, 2in. Pilch: Length, 8in.; all round above the gusset, 21in.

MATERIALS needed are 3oz. of 3-ply wool, two No. 10 and two No. 12 knitting needles, four buttons, and ½yd. of narrow elastic.

The tension should be 7 stitches to the inch over stocking stitch and 7½ stitches to the inch over pattern.

Abbreviations used are: K., knit; p., purl; st., stitch; tog., together; patt., pattern; rep., repeat; g. st., garter stitch (every row k.); st. st., stocking stitch; inc., increase; dec., decrease; beg., beginning; sl., slip; p.s.s.o., pass slip stitch over.

Vest Front

With No. 10 needles cast on 58 st. and work in g. st. for ½in.

Work in patt. thus: First row: K. 2, * p. 2, k. 2. Rep. from * to end. Second row: P. 2, * k. 2, p. 2. Rep. from * to end. Third and fourth rows: As first row. These four rows form the pattern. Continue in patt. until the work measures 9½in. from the lower edge.

Work in g. st. for ½in. Next row: K. 19, cast off 20, k. to end. Work in g. st. on the last set of 19 st. for ½in. Cast off.

Rejoin the wool to the remaining 19 st. Work in g. st. for ½in. Cast off.

Vest Back

Proceed as for the front until the work measures 9½in., then work a further ½in. in patt.

Work ½in. in g. st. Next row: K. 19, cast off 20, k. to end.

Work on the last set of 19 st. in g. st. for ½in., ending at the outside edge. Next row: K. 5, cast off 2, k. to last 5 st., cast off 2, k. to end. Next row: K. 3, cast on 2, k. 7, cast on 2, k. 5.

Work 3 rows in g. st. Cast off.

Work on remaining 19 st. to match.

Vest Sleeves

Fold the buttonhole flap over the g. st. top of the front and sew them together at the end.

With right side of work facing, and using No. 10 needles, beginning 7in. from the lower edge of the front, k. up 54 st. along the armhole edge, ending 7in. from the lower edge of the back.

Work in patt., beginning with the second row, until the work measures 1½in. from where the stitches were picked up.

Change to No. 12 needles and work in g. st. for ½in. Cast off.

Work the other sleeve in the same way.

Pilch

With No. 10 needles begin at the front edge of the waist and cast on 72 st.

Change to No. 12 needles and work ½in. in k. 2 p. 2 rib, then make holes thus: Next row: * Rib 2, make 1, p. 2 tog. Rep. from * to end. Continue in rib until the work measures 1½in.

Change to No. 10 needles and continue in st. st. until the work measures 5¼in., ending with a p. row.

Shaping the Gusset

Next row: K. 31, k. twice into next st., k. to last 33 st., k. twice into next st., k. to end. Next row: P. to end. Rep. last two rows 11 times (96 st.).

Next row: Cast off 32 st., k. to last 32 st., cast off 32 st. Break off the wool, rejoin it to the remaining 32 st., and work in three rows in st. st., ending with a p. row.

Next row: Cast on 32 st., k. to end, cast on 32 st. Next row: P. to end (96 st.).

Next row: K. 32, sl. 1, k. 1, p.s.s.o., k. to last 34 st., k. 2 tog., k. 32. Next row: P. to end. Rep. last two rows 11 times (72 st.).

Continue in st. st. until the work measures the same as the front side to the lower edge of the waist ribbing, ending with a p. row.

Shaping the Back

First row: K. 42, turn. Second row: P. 12, turn. Third row: K. 18, turn. Fourth row: P. 24, turn. Fifth row: K. 30, turn. Sixth row: P. 36, turn.

Continue thus, working in st. st. and taking up six extra stitches on every row until all stitches are worked on one needle.

Change to No. 12 needles and work 1½in. in k. 2 p. 2 rib, making holes to match the front.

Cast off loosely with a No. 10 needle.

Making up

Vest: Press the work lightly with a warm iron and a damp cloth. Join the side seams. Sew buttons on to correspond with the buttonholes.

Pilch: Press the work lightly with a warm iron and a damp cloth. Join the side seams. Work a row of picot edging all round the leg loosely thus: Begin at the seam with 1 single crochet into the edge, * 3 chain, 1 double crochet into the first of these chains, miss next st. of foundation, 1 single crochet into next st.; rep. from * all round. Thread elastic through the holes at the waist. Press all seams.

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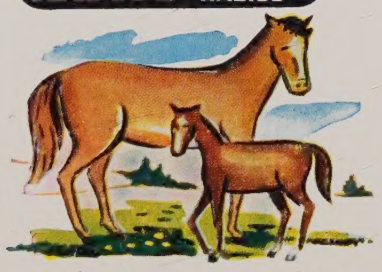

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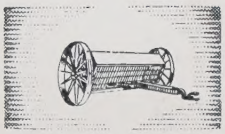

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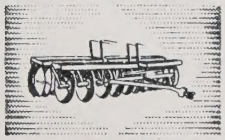

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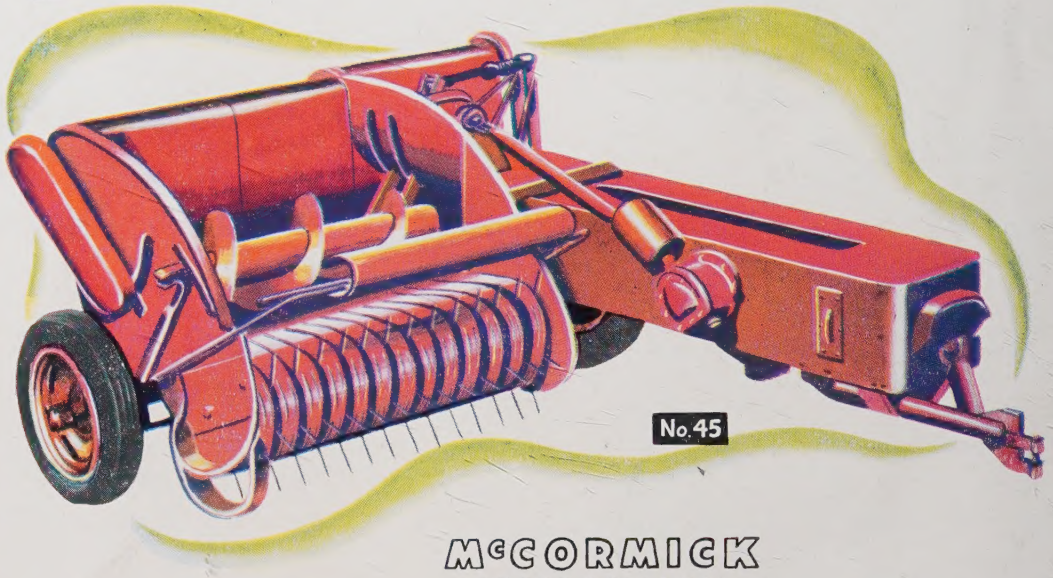

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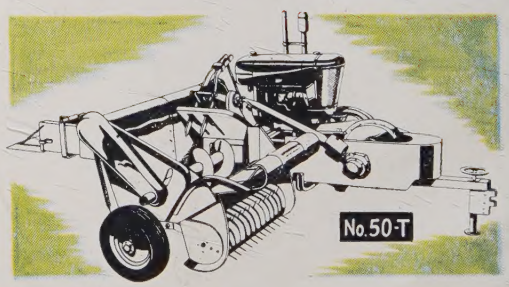

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